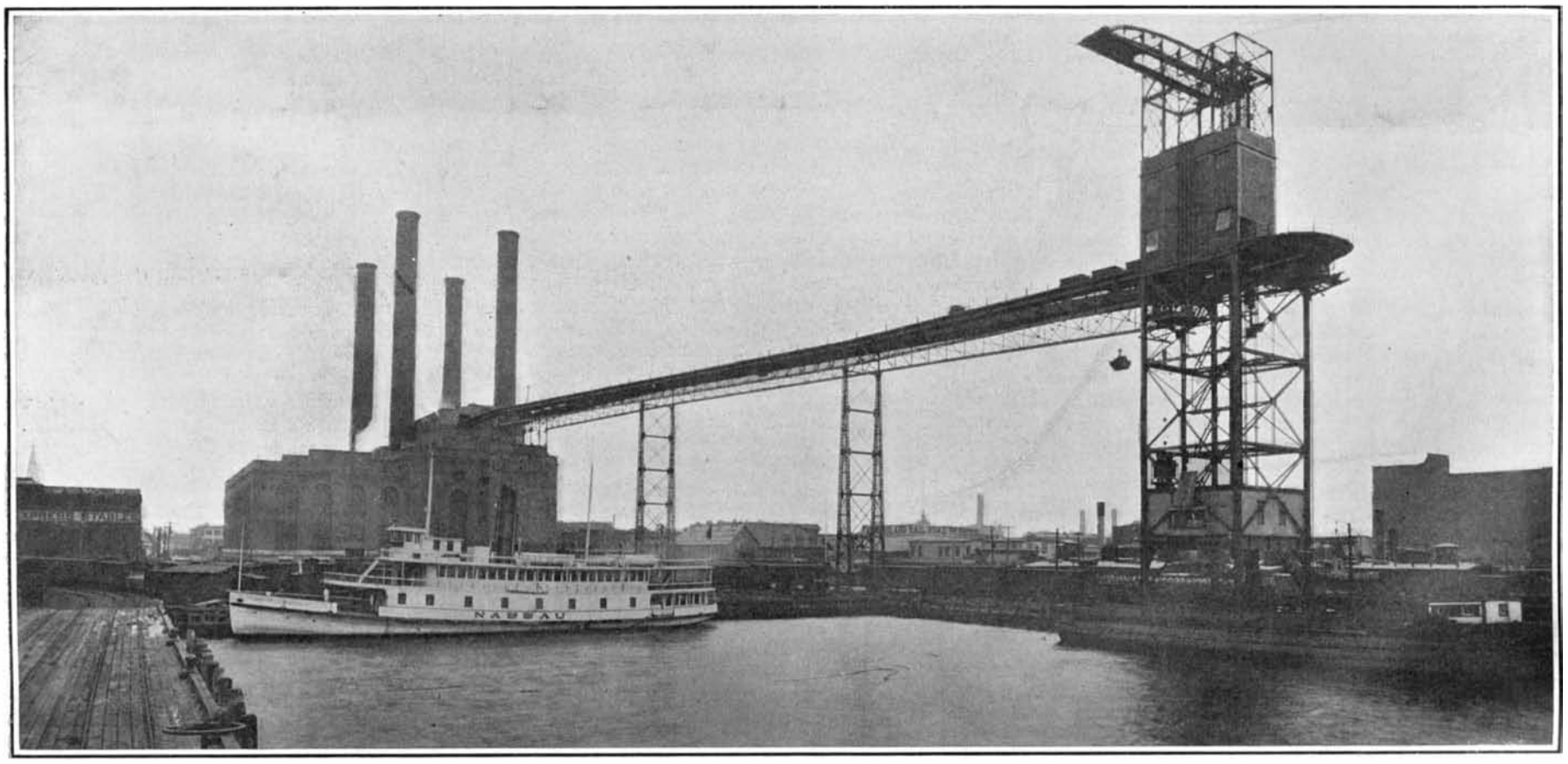
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1906, by Munn & Co.]

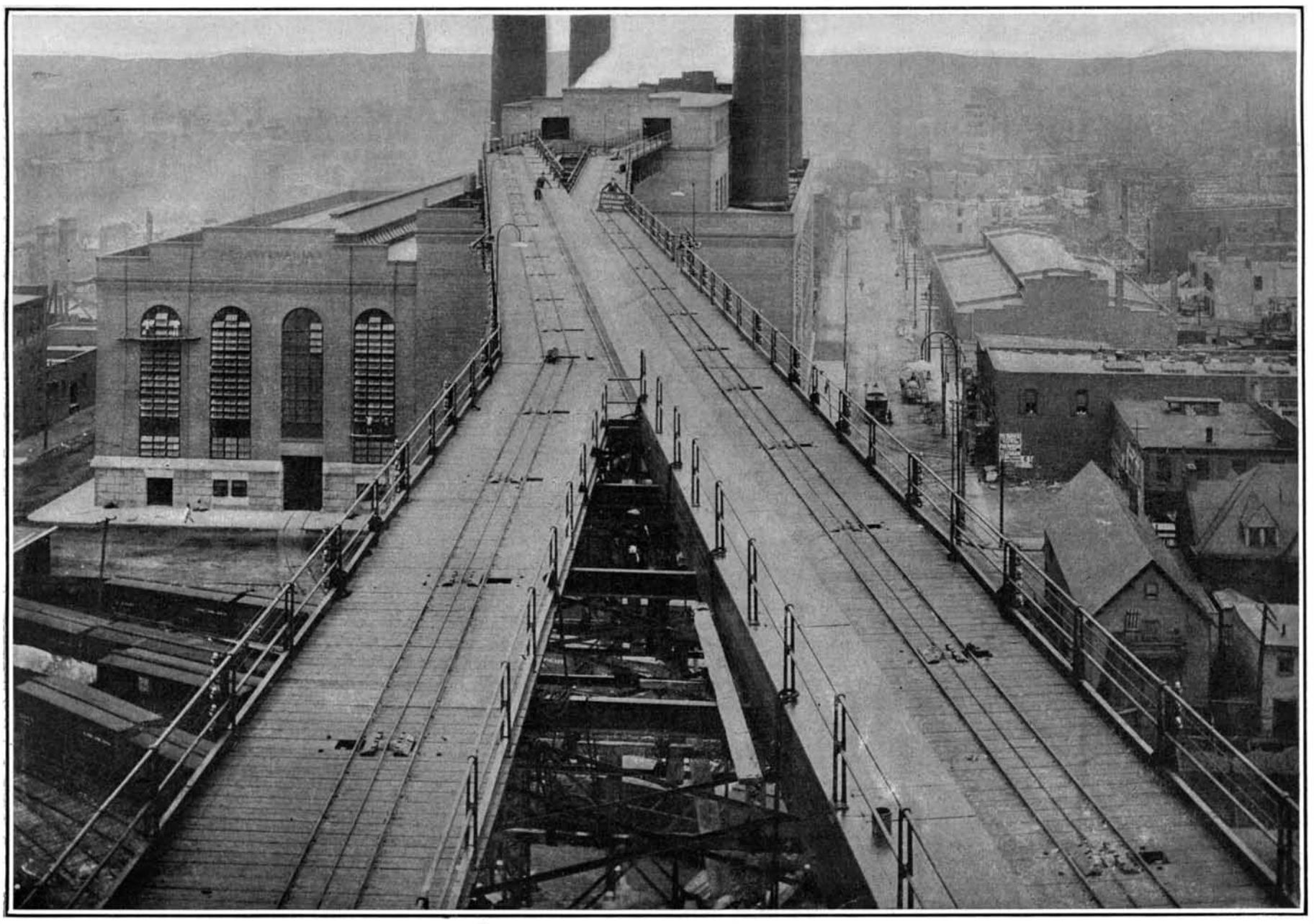
Vol. XCIV.—No. 14.
ESTABLISHED 1845.

NEW YORK, APRIL 7, 1906.

10 CENTS A COPY.
$3.00 A YEAR.

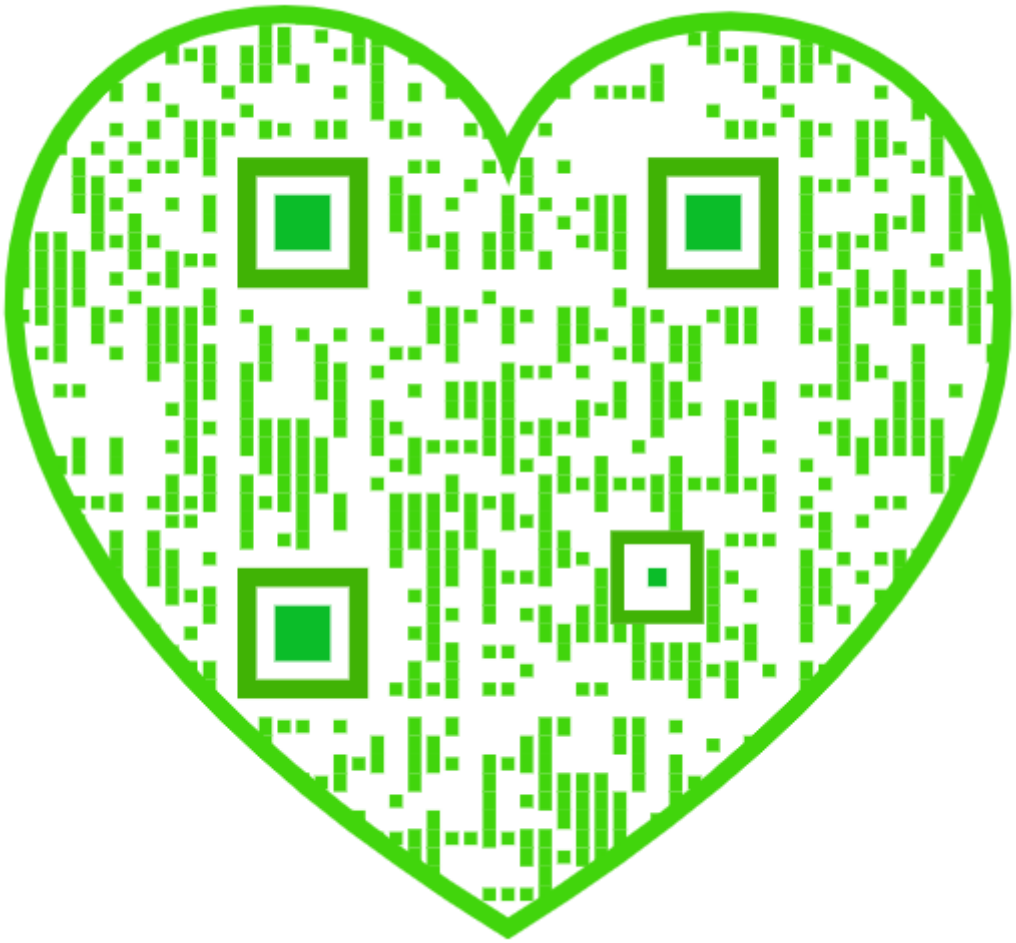


View of Power Station from River, Showing Coal Tower in Operation.



Coal Bridge and Cable Railway Over Which the Coal is Taken from the ~~Coal~~ Tower to the Coal Bin.

PENNSYLVANIA RAILROAD'S EXTENSION TO NEW YORK AND LONG ISLAND.—THE LONG ISLAND CITY POWER STATION – [See page 285.]



SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
American Homes and Gardens..... 3.00 "
Scientific American Export Edition (Established 1878)..... 5.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, APRIL 7, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE BEHRING SEA TUNNEL.

It is unfortunate that a project for the construction of a railroad in Siberia, to run from Behring Sea to a junction with the Siberian Railroad, should be handicapped at its very outset by identifying it with the absurd and impossible proposal to build the railroad tunnel beneath Behring Strait. Like the English Channel tunnel, the Behring Sea suggestion is one that seems to have taken a firm hold on the mind of what might be called the engineering romanticists, and it takes only a very slight occasion to open the flood gates to a whole mass of rhapsodical outpourings about these "engineering triumphs" and "masterpieces of modern construction," which are to bring "unlimited benefits to commerce." As a matter of fact, not even the English Channel tunnel, which would certainly command from the very day of its opening a heavy traffic, if not profitable financial returns, is likely to be built for several decades to come, if ever. As to the Behring Sea tunnel, it would be located at a distance of 3,000 miles from the Siberian Railroad, and about 2,000 miles from the nearest point on the most northerly of the transcontinental railroads in America.

Undoubtedly the activity in railroad construction which is evident to-day in Alaska will be permanent; and if the country fulfills its great promise of unexplored mineral wealth, no doubt the Alaskan railroads will be carried well up to Behring Strait. It is also certain that Alaska will ultimately be connected by an all-rail route with the railroad system of the rest of the United States. The prospects of a connecting railroad in Russian territory are at present apparently dependent upon the success of an American company, which has been seeking concessions from the Russian government. Their efforts, according to recent cable dispatches, have been successful, the Czar being favorably disposed toward the enterprise. This company, which believes that Siberia is as rich in gold as Alaska, offers to construct a tunnel and build a road 3,000 miles long from East Cape to Kansk, in the government of Yeniseisk, where it will join the Siberian railroad; and in consideration of this, the company is to receive alternate sections of eight miles on either side of the line, together with valuable mining concessions. Should this road be built, its source of revenue would be entirely local, and any returns must necessarily wait upon its settlement by immigration and the development of the supposed mineral wealth.

That there will ever be a considerable amount of through travel by way of Behring Sea is very unlikely, or that a Siberian-Alaskan route would ever become, even in the event of the construction of a tunnel, a popular route between the United States and Europe. The construction of the tunnel would be an enormously costly undertaking. With its approaches it would be not far from forty miles in length, and because of the extremely high cost of labor in that inhospitable region, the total cost would probably exceed one hundred million dollars. But the most serious question of all, as showing the impracticability of a tunnel, is that of the great depth to which it would have to be carried. The depth of water is variously stated at from 160 to 170 feet, which means that the sub-grade of the tunnel would have to be at minus 200 feet, in order to secure firm overlying material, and a rock which was impervious to water. Should any fissures be encountered at this depth, the tunnel would have to be abandoned; for the use of the pneumatic process would be out of the question, the corresponding air pressure of about 90 pounds to the square inch being, of course, fatal to life.

SEVEN-HUNDRED-MILE ELECTRIC TRANSMISSION.

It is gratifying to note that the technical press has sounded a note of warning against the preposterous proposal to generate hydraulic-electric power at the Victoria Falls of the Zambesi River, and transmit it over a distance of 745 miles for use in the gold mines at Johannesburg. But, although the proposal to deliver this power at a figure that would be at once economical to the consumer and profitable to the company has been ridiculed by the technical press, the lay public is liable to be misled by a scheme which, on the face of it, would seem to hold out flattering prospects of success. At the present time the most important transmission of energy for commercial purposes is that from Niagara to Buffalo, where the distance covered does not exceed about 20 miles. The longest transmission, according to present information, is that which is in successful operation in California over a distance of about 220 miles, so that the proposed transmission line in South Africa will be 340 per cent longer than anything that has yet been attempted. According to Prof. William E. Ayrton, who not long ago made a severe criticism of the scheme in the London Times, the Johannesburg mining district consumes about 150,000 horse-power, at an average cost of $100 per horse-power per year. Niagara sends 24,000 horse-power to Buffalo, where it is sold at about $125 per horse-power per year, and Buffalo, as we have noted, is distant from Niagara only 20 miles. Furthermore, in the neighborhood of Johannesburg are abundant supplies of coal, of which an excellent quality can be delivered on the Rand for from $2.60 to $2.00 per ton. Even if the Victoria Falls plant were to be built, and a great transmission line constructed, it is not likely that the important mining industries in Johannesburg would be willing to trust the operation of their costly plants to the integrity of a few copper cables extending for over 700 miles through the wilds of a savage country.

CHEAP ALCOHOL FOR MOTORS.

Alcohol is so important a fuel that its industrial use should not be restricted by heavy taxation. No doubt the laws which render its use burdensome to those who would employ it as an engine fuel have been enacted in the interests of the common good, and yet some legislative encouragement should be given to the employment of low-grade industrial alcohol which is unfit for consumption without in any way removing existing limitations to the sale of wines and liquors. The benefits to be derived from a free use of alcohol in the arts have been clearly set forth by Prof. Elihu Thomson in a statement made before the Ways and Means Committee of the House of Representatives, which statement will be found summarized in the following:

At the works of the General Electric Company in Lynn a Deutz alcohol engine—a type of engine made in Germany especially for use with alcohol—was recently tested and the results have been such as to prove without doubt the entire suitability of alcohol, if cheap enough, as a fuel for internal-combustion engines. This particular engine is to be sent to the Island of Cuba and coupled to a dynamo for lighting. It will be operated with the cheap Cuban alcohol, which is sold there at about 12 or 15 cents a gallon. A few gallons of this alcohol was obtained and used in the tests and it was found to be a high-grade spirit containing 94 per cent alcohol by volume and 6 per cent water, or about 90 per cent alcohol by weight. While it is not methylated or denatured, there is no question that the behavior in the engine of denaturated or methylated spirit would be identically the same as with the pure-grain alcohol.

To obtain this sample of Cuban alcohol it was necessary that an import tax of $4 a gallon be paid with other charges, which increase the cost of material enormously as compared with its actual value in Cuba.

The experiments developed the fact that alcohol is suitable as a motor fuel even when it contains as high a percentage as 15 per cent of water. Notwithstanding the fact that the heating value of alcohol, or the number of heat units contained, is much less than that in gasoline, it is found by actual experiment that a gallon of alcohol will develop substantially the same power in an internal-combustion engine as a gallon of gasoline. This is due to the superior efficiency of operation when alcohol is used. Less heat is thrown away in waste gases and in the water jacket.

The mixture of alcohol vapor with air stands a much higher compression than does gasoline and air without premature explosion, and this is one of the main factors in giving a greater efficiency. It follows from this that, with alcohol at the same price as gasoline, the amount of power developed and the cost of the power will be relatively the same so far as the fuel itself is concerned, but on account of the higher efficiency of the alcohol, less cooling water is required, or a less percentage of the heat of combustion is communicated to the cylinder walls of the engine. The exhaust gases from an alcohol engine carry off less heat. They are cooler gases.

Exhaust gases from a gasoline or kerosene engine are objectionable on account of the odor. In the tests of the Deutz alcohol engine there was absolutely no such objection with the alcohol fuel, the exhaust gases being but slightly odorous, or nearly inodorous. Alcohol possesses a considerable tolerance as to richness or poorness of the mixture in the engine, and even when there is considerable excess of alcohol for the air the exhaust is not disagreeable in odor, a condition which with either gasoline or kerosene leads to a smoky, bad-smelling exhaust. The importance of a fuel which does not produce disagreeable exhaust gas is greatest in the case of stationary engines of considerable power, as in that case the exhaust is emitted in one locality and may become a source of nuisance. This has often been experienced with gasoline or kerosene engines and has tended greatly to limit their application, particularly in densely built-up sections.

A large number of agricultural products are easily capable of being converted into alcohol, and such products as are unmarketable, either from overabundance of crops or defective growth or damage, are still available as sources of supply. Hence each agricultural district would be able to supply itself with all the motor fuel needed and at the same time produce for other districts. Inasmuch as alcohol can be stored in tanks for an indefinite period without change in its nature, any surplus production of alcohol can easily be taken care of. A prominent beet-root sugar manufacturer gave it as his opinion that from the waste of the beet-root sugar industry alcohol could be produced at a cost of about 10 or 12 cents per gallon. It is probably true that from other agricultural wastes, such as fruit parings, fruit partly decayed, surplus corn, etc., a cost equally low might be realized.

It is reasonable to infer that, freed from tax, there is no possible substitute for this valuable fuel which could be supplied at such a low cost. It may be mentioned in conclusion that the efficiency—that is, the ratio of the conversion of the heat units contained in the fuel into power—is probably higher in the alcohol engine than in engines operated with any other combustible, and doubtless, on account of the comparative newness of the alcohol engines, there is still room for some improvement in that respect.

A PRACTICAL APPLICATION OF THE AVERSION OF EELS FROM LIGHT.

According to the Biological Society of Copenhagen a very interesting and novel experiment is shortly to be made in the northern portion of the narrow straits called the "Little Belt." Electric lamps are to be fixed at the bottom of the sea, with a view to preventing the conger eels from making their way out into the open sea, to the great detriment of the coast fishing industry. Eels belong to the Murænidæ, a family of physostomous fishes distributed in almost all fresh waters and seas of the temperate and tropical zones. The two British forms are the conger (*Conger vulgaris*) and the common eel (*Anguilla vulgaris*). The conger is scaleless, and has a wide distribution in the sea; it reaches a length of 8 feet, but rarely exceeds 6 or 7 feet.

The eel is a peculiar creature in many ways, and its propagation has always been involved in mystery; the floating eggs of some species of eels have been found in the Bay of Naples, and the young have been recognized in small, peculiar, transparent fish, formerly known as Leptocephali, which, by the bye, undergo interesting transformations. It appears certain that eels migrate into the sea to spawn, that the spawn is pelagic, and hatches in the sea, where the young undergo their transformations. The males are smaller than the females, and the eggs are very numerous. Eels are much esteemed on the Continent and in England, London boasting of several eel-pie shops, and fish restaurants where stewed eels and eel soup are prominent items of the bill of fare. In Scotland there is a great prejudice against them, and also in some other countries such as Abyssinia. Eels are imported largely from Holland and Denmark, in which latter country the experiment referred to is being made.

Another peculiarity of the eel is that it shows a marked fear of light; to such an extent is this the fact that the conger will not migrate to the open sea when the moon is at the full. This weakness is to be turned to good account, in order to confine the congers within the limits of the Little Belt; this will be done by having the northern egress of the straits brilliantly illuminated by means of groups of powerful electric lamps securely fastened at the bottom of the sea, so as to control the point of exit in question.

THE CHANCES OF LIVING IN A MODERN BATTLE.

In Homeric days a battle was a conflict of armed mobs. The nearer you got to your assailant, the better was your chance of killing or being killed. The bigger the man, the better were his chances in the strife. In these piping times of mechanical warfare, the situation is reversed. Battles are fought at ranges of a mile or so. The smaller the man, the less are his chances of being hit. An ingenious mathematician has figured out that perhaps the casualties on the Japanese side must have been considerably less than those of the Russians in the recent war, if it be assumed that the marksmanship of each was equally good.

The advantage of the Japanese was inversely as the cubes of their height and breadth. The average targets offered by each to the enemy are as the cubes of 1,585 and 1,642, or as 106 to 118, an advantage in favor of the Japanese of about 12 per cent.

AN OPEN LETTER TO THE MAYOR.

To the Honorable the Mayor of New York City:

In making the departure from the conservative policy of this journal, which is involved in our addressing the present open letter to the Chief Executive of this city, we believe that your Honor will credit us with being actuated solely by motives of concern for the interests of the great municipality over which you have always exercised such a faithful oversight.

We feel that sufficient justification is found for this letter in the fact that its subject matter is such as comes peculiarly within the province of a journal which, for the past sixty years, has devoted much of its space to the exploitation of the great engineering structures that have so largely contributed to the fame of the city of New York.

In the discharge of your multifarious duties, you must necessarily depend for information and guidance upon the representations made to you by the heads of your many departments; and in cases where the subject matter is of a purely technical character, as, for instance, in those coming within the province of the bridge department, the correctness of your final judgment must necessarily depend upon the completeness with which all sides of any subject of controversy are laid before you by your technical advisers.

The object of this letter is to present for your consideration certain facts regarding the present deplorable delay in the construction of the Manhattan Bridge. We believe we are justified in saying that among all the important public works now under construction, there is none so greatly needed as this; and none, therefore, in which more strenuous effort should be made to facilitate rapid construction. Yet, as matters now stand, we are confronted by the astonishing fact that, after two and a quarter years of incumbency of office, your Bridge Department has not only done nothing toward the actual erection of the steelwork of this bridge, but the specifications are not even yet in shape for the bridge companies to put in their bids. Considering the urgency of the work, this alone, it would seem to us, is a delay which approaches, if it has not already reached, the proportions of a public scandal.

The situation is greatly aggravated by the fact that, when the present department took office, it found on file a complete set of plans for this very bridge, which had been designed by engineers of acknowledged authority on suspension bridges, and approved by a non-partisan commission of some of the most eminent bridge engineers in the world. That the indorsement of this commission was in the highest degree authoritative, will be evident to your Honor when we mention that it included the late Mr. Morison, a past president of the American Society of Civil Engineers, and Mr. Theodore Cooper, whose Specifications for Bridges are standard throughout America. The plans which your department found on file had been drawn with a special view to economy of cost and rapidity of erection; features which were gained largely by the substitution of the eye-bar chain for the wire cable. The expert engineering commission referred to indorsed the plans in every particular. Had bids been called for and the work pushed forward, it is certain that the bridge would at this time have been three-fourths completed, with the prospects of its opening within the period of your present administration.

In spite of the city's urgent need of the bridge, the engineers of your Bridge Department, who must have been aware that the indorsement of engineers of the high professional ability of the members of the expert commission placed the practicability of the eye-bar plans beyond question, took the astounding course of ignoring these plans altogether, and committing the city to the delay and expense involved in preparing a new set of plans of their own.

This action has involved already an expenditure of $100,000 for new plans; a delay of two and a quarter years in the construction of the bridge; and a lawsuit, due to an illegally-drawn specification, which may easily cost the city $500,000 in damages. In justification of their action your Bridge Department has alleged that the eye-bar cable design would cost more and take longer to build than the wire-cable design. It has been suggested by this journal that in order to place the two sets of plans on an even basis, they both be submitted to an independent board of engineers for comparison. Your Bridge Department has always opposed, and very strongly opposed, this suggestion.

In order to ascertain from the bridge companies, who will be likely to bid on the Manhattan Bridge, their opinion as to the merits of the two designs, letters were recently sent by the Merchants' Association of this city to several of the leading firms asking for their opinion. They replied that they would be prepared to build eye-bar cables which would be up to the Bridge Department specifications; that the bridge would be cheaper to build; and that it could be built in less time than a bridge of the wire-cable type. They also stated that they would be prepared to bid upon the plans of the eye-bar cable bridge as they now stand on file in the Bridge Department.

Although some work has already been done upon the cable anchorages, we are in a position to assure your Honor that, by a piece of good fortune, they have been constructed of such a form and of such size and weight that they will serve their purpose equally well for either type of bridge.

Summing up, we beg your Honor to consider the following facts as between these two sets of plans:

That the eye-bar plans were drawn by engineers who, having in view the desirability of quick construction, adopted the eye-bar system because of its great facility of erection and smaller cost.

That these plans were submitted to an independent board of bridge engineers of high professional reputation, who gave them unqualified indorsement.

That several bridge-manufacturing companies have stated (1) that they are prepared to bid upon the plans; (2) that they can furnish eye-bars of the size and structural quality specified; and (3) that the bridge can be built more quickly and for considerably less money than one of the wire-cable type.

That the wire-cable plans, as completed by the Bridge Department, have never been submitted for the consideration of any outside board of experts.

That your Bridge Department officials have, on the contrary, thrown every obstacle in their power in the way of such discussion of these plans by an independent commission.

That the "strain sheets," or figures showing the calculations of strength of the various parts of the bridge, from which alone any comparison of the wire with the eye-bar design could be instituted, have never been made public, even to the contractors—an absolutely new procedure in the history of bridge building in America.

That this premeditated and carefully-guarded secrecy has raised an inevitable and very reasonable doubt in the minds of the technical world, in which we strongly share, as to the ability of the wire-cable plans to stand comparison with the plans for which they were substituted.

Finally, and in view of the above facts, we respectfully submit to your Honor, that in order to safeguard the interests of this city in this matter, it is advisable that you should instruct the engineers of your department to offer both sets of plans for bids, and thereby make sure that, whether the eye-bar or wire-cable type be selected, the city will secure the cheapest possible bridge in the least possible time. THE EDITOR.

THE MODERN PHILOSOPHER'S STONE.

One interesting deduction can be made as a result of the disintegration of radium into helium—a deduction which has a great bearing on the ancient problem of the transmutation of baser metals into gold, and which has been admirably set forth in a recent paper by Prof. Frederick Soddy. Although we cannot yet transmute one metal into another, we know very well why that has never been accomplished. Radium evolves for every gramme weight 100 calories of heat per hour, and since in a year only one-thousandth part changes, it follows that the total energy in the complete disintegration of a gramme of radium must be enormous. It is roughly about a million times that given out by a similar weight of coal burning. If 30 milligrammes of radium were all to disintegrate suddenly, the effect produced would equal the explosion of about a hundredweight of dynamite. Uranium in its complete disintegration produces radium, and hence the amount of energy evolved must be as much greater than in the case of radium, as the whole is greater than the part. If we could artificially accelerate the rate at which radium or uranium disintegrates, we should, on the one hand, have achieved transmutation of a heavier element into lighter ones, and, on the other, have rendered available for use a new supply of energy a million times more powerful than any source at present known. If we succeeded in artificially transmuting uranium there is little doubt that the same means would be applicable to the other elements. Hence the supply of energy would be inexhaustible. But let us see what the old attempt of the alchemist involved. When he was concerned with building up a heavy element like gold from a lighter like silver, he was attempting a most profitless task. The energy absorbed would cost far more than the value of the gold produced. The energy of some hundreds of tons of coal would have to be put into the silver to turn it into gold. But where he was attempting to produce gold out of a heavier element like lead, not only would he have got the gold from the lead, but also a store of energy would have been released in the change of far more intrinsic and commercial value than the gold.

Is radium ever likely to be of any practical use? It may, or it may not, light our lamps or drive our motors. The assured certainty is that if it is ever made to do either of these things, man as we know him will quickly follow his steam engine and dynamo into the museum. At present we have not found how to control the gigantic forces, or to affect the tremendous processes we have so lately discovered, and we never may. The important point is that by these discoveries the relations of mankind to Nature have undergone a certain change, and he has caught a glimpse of some latent possibilities within his legitimate destiny which cannot be effaced. Energy is the life of the physical universe. You cannot multiply the existing store by a million and leave things as they were. But the recognition of the internal energy of matter has done this within the progress of the century which has just begun. A journey to the moon to-morrow *may* rank with the half-penny car ride of to-day, or the warming of a house with the thawing of an Arctic continent. To-day, so far as any use of the new knowledge is concerned, the one is as impossible as the other, but none would venture to deny to the future the possibility.

A NEW ARMY SIGNALING APPARATUS.

Signaling from station to station is not the easy matter it seems. In order that an object on shore used as a signal may be seen by the observer on a tug, 9,000 yards away, there must be a strong contrast of color between the signal form and its background; else the form cannot be distinguished from the background. First of all, then, this contrast of color must be secured. How the obstacle may be overcome is pointed out by Capt. Thomas E. Merrill, of the Artillery Corps, in an article published in the Journal of the Military Service Institution. Broadly speaking, his apparatus is constructed very much like a huge window-shutter, inasmuch as it depends for its effect on the simultaneous movement of a number of hinged boards.

Capt. Merrill finds that the objects used to represent signals must be all either white or black and their background of the opposite color. The easiest background to provide is a dark one. A grass or earth slope, while of course not black, will generally answer the purpose. Then the signal forms must be white. A white surface in shadow shows dark at long distances. Therefore, in the general case it is necessary to use a surface whose face toward the observer is so inclined as to not be in shadow.

At Fort Heath a plane surface 15 by 40 feet with a fall of fifteen feet in the forty has been found to work very well when not in shadow, and on account of its inclination, fairly well even when in shadow.

The plane surface consists of inch boards each a foot broad and fifteen feet long extending across stringers that run parallel with the long direction, there being forty of these boards. Every fourth board from the top is hinged to the preceding board, and all the hinged boards are so arranged by a system of levers and counterweights that all can be simultaneously raised to a vertical position or lowered to a position where they form part of the plane surface.

The plane surface is painted white. The underside of the hinged boards and the stringers under the hinged boards are painted black. When the hinged boards are vertical the apparatus looks black from the front because each hinged board covers the preceding white boards to such an extent that they are invisible to an observer situated to the front and on a slightly lower plane.

The operation of the apparatus resembles that of the heliograph. Normally the white surface is in view. The observer on the tug watches the white surface. When a signal is to be sent the white surface disappears, due to the raising of the hinged boards. The apparatus has been found to work almost as rapidly as the heliograph and (an important advantage) is easily operated by one man.

The appearance presented to a distant observer when a message is being sent is as though a vertical square 15 feet on a side changed uniformly throughout its entire surface from black through all the intermediate shades to white and *vice versa*. At a distance one does not see, as the square changes from black to white, a succession of bands of white increasing in width until the entire surface is white, as one might at first thought expect, but just a uniform change in color over the entire square. For artillery target practice a single letter would indicate a prearranged command.

The signal apparatus described was used with complete success for the entire subcaliber and service practice of Forts Banks and Heath during the fall of 1905. During the service practice the range of the tug varied between 4,000 and 7,000 yards. The practice lasted from about 8:30 A. M. until about 4 P. M. the same day. It is safe to say that at least one hundred signals, each a single letter, were sent during the day. Not one was repeated and not one was misunderstood.

A Swiss company has received the order for equipping the Valle-Maggia Railway from Locarno to Bignasco on the single-phase system. The line is 17 miles long, with a maximum gradient of 3.3 per cent, and the gage is 3 feet 3 1-3 inches. A trolley voltage of 5,000 volts is to be employed. It is intended to obtain the necessary power for working the railway from a waterfall.

A COMBINED LONG AND SHORT RANGE AUTOMOBILE SEARCHLIGHT.

An automobile searchlight, called the Besnard projector, has just been brought out, which is provided with means for suppressing, at will, the blinding effects of such lights. The optical part of the apparatus comprises a lens of long focus and a hyperbolic reflector. Optical diagrams of this reflector are represented in Figs. 1 and 2, which show that the projector is capable of casting both a long-range beam and a short-range or local cone of light. As shown in Fig. 1, the rays of the powerful long-range beam are rendered parallel by a lens and a hyperbolic mirror *M*.

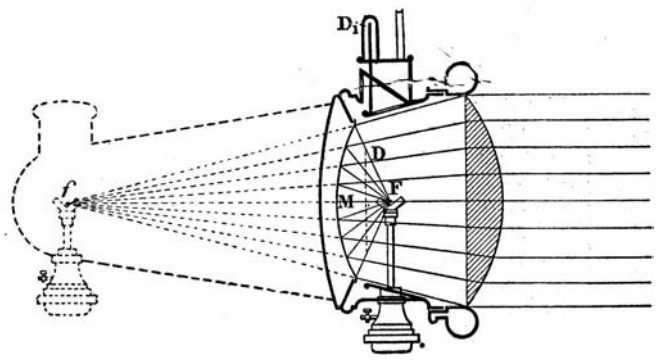


Fig. 1.—Diagram of Arrangement for Long-Range Illumination.

The combined effect of the lens and mirror is to project the rays as if they emanated from the common focus *f*, whereas the flame is actually located at the second focus *F* of the hyperbola. Due to this arrangement, it has been possible to utilize a powerful lens of wide diameter on a projector of comparatively small size. The dotted lines of Fig. 1 indicate the cumbersome dimensions that would be possessed by the projector, were the hyperbolic reflector not used. Fig. 2 shows the effect of the lens upon the rays coming directly from the flame *F*, which are refracted in a divergent beam that produces a very brilliant and spreading light in a zone near the vehicle.

The long-range beam and the local cone combine, as in Fig. 3, to form a stream of light that overspreads the entire road from the origin of the luminous cone in front of the carriage to a very great distance ahead. The short-range light provides a luminous cone of such an extent as to permit of seeing objects in the immediate vicinity of the automobile, and this proves very useful on mountain or winding roads or at dangerous turns. The illuminating power of the long-range beam has its disadvantages in certain surroundings. For example, pedestrians in cities are discommoded by the glare of the searchlight to such an extent, that Paris and several other municipalities of France have been compelled to forbid the use of blinding lights within the corporation limits. Then, again, it is apt to frighten horses and cause serious accidents. Finally, there is no chauffeur who has not himself been blinded by the searchlight of an oncoming automobile at the moment when it was most necessary for him to attend to his steering.

A very ingenious arrangement applied to the projector permits of obviating such inconveniences. In Fig. 1 a disk is shown which may occupy either the dotted position *D*, behind the flame, or that of D_1 indicated by full lines in the top of the lamp. In the first position *D*, the disk intercepts the luminous rays which are directed toward the reflector, and thus suppresses the powerful long-range beam of light. However, the local illumination (Fig. 2) persists, and permits the driver to make his way in a lighted city, or even on the highway at a reduced speed. If, on the contrary, the disk be raised to the position D_1 in the top of the lamp, the entire light of the projector will be brought into play. Fig. 3 shows the intense light that the projector throws upon the road when in full operation, and Fig. 4 the non-blinding light produced after the disk has been lowered.—Translated from L'Automobile for the Scientific American.

The Kashmir electric supply machinery will be made in America.

Japan's Merchant Marine.

Since the close of the war with Russia, Japan has entered actively upon the extension of its merchant marine, and there are indications of a purpose to make the Japanese flag supreme in oriental waters. Consul-General Rodgers, of Shanghai, furnishes an interesting report on this matter, which follows:

During the period of comparative quiet which followed the practical end of the war in early June and continued until the signing of the peace treaty there was little evidence of the present-day activity in the Japanese shipping business, but now it is apparent on every side and is especially noticeable in Shanghai, a port which will be used more in the near future by the Japa[illegible] than perhaps any other nation. The magnificent water front owned by the Nippon Yusen Kaisha (Japanese Steamship Company), formerly the property of the Pacific Mail Steamship Company, from which it was bought for a small portion of its present value, is occupied by a long line of pontoons and godowns, and from and to these a constant stream of cargo is being handled by Japanese steamers of light draft, which are not hindered by the Whangpoo bar. The regular and subsidiary ships of the Nippon Yusen Kaisha are being added to by coasting ships which will ply in all directions, even the Yangtse service having been entered with determination. The activity of the Japanese carrying trade to the north is marked, and but recently, by the institution of an agreement between the Nippon Yusen Kaisha and the Deshler Line (under the American flag), of Kobe, there is provided a weekly service to all Korean ports *via* Moji, with Kobe and Shanghai as the terminal points. It is well understood that the Japanese are determined for the present to make Kobe and Moji their great shipping ports, and that Shanghai will be their Chinese base.

The news of the intentions of the Japanese as to their merchant marine of course is at second hand in Shanghai, but semi-official announcements have been made that every port touched by Pacific waters will soon be reached. It is known that a line from Hongkong to Australia, *via* Manila, will soon be developed into a rival in importance of the trans-Pacific. In the meanwhile the shipbuilding companies of Japan are building new vessels, repairing old ones, altering captured craft, and in every way preparing to adapt everything they have afloat to the new field of Japanese endeavor. If the half that is told of Japanese intentions as to merchant marine is true, then an activity will ensue on the Pacific Ocean which will astonish the world. It is too late this year to get the full development, but one year from now, unless unforeseen causes intervene, there will be a wonderful Japanese fleet afloat, and every one of the nations which have practically monopolized the sea traffic in the Orient will have to look to its laurels.

This anticipation, which is current in Shanghai especially, is causing great uneasiness for the reason that many see in it a promise of the necessity for a frequent readjustment of freight tariffs and a consequent diminution of profit. At present there is some uncertainty as to these tariffs, the war rates having been abated as necessity demanded. Those best informed predict entire new schedules, and it is certain that many new plans will have to be inaugurated to meet the competition. Whether Japanese vessels can be successful under these conditions is another question entirely. Many well-informed persons argue that they cannot; that the thing will be overdone and will be ruinous to them. It is also asserted that the Japanese cannot operate ships as economically as Europeans, and that there is no special advantage in their favor. But whatever may be the financial outcome to the Japanese, it is entirely probable, in view of all the conditions, that some of the large shipping firms, and especially the American trans-Pacific lines, will, in the near future, proceed upon a different programme and require ships of smaller tonnage for China coast service. Not alone on salt water is Japan making her advance. On the Yangtse she will certainly have a large fleet and upon the smaller rivers and canals as well. The carrying trade at Hangchow *via* the Whangpoo and the Grand Canal she already shares to a great extent, the service being conducted by small towing launches and lorchas. Soochow, Huchow, and other canal cities will also receive attention, and it is understood that her small coasting ships to places like Ningpo with be numerous. The Chinese apparently offer no impediment to these plans; on the contrary, they appear to welcome them. In no way is the evident determination of Japan to inaugurate a commercial conquest of the Orient more apparent than in the announced diffuse intentions of her merchant marine. Instances to prove this are plenty. In fact, one has but to inspect the present sailing lists of the Osaka, Shosen, and the Nippon Yusen Kaisha and its allied lines to note that not a route has been forgotten at present. And in addition to that it is well known to everybody that the shipyards of Japan are the busiest places in the East to-day. The tonnage being prepared for service is enormous and the work goes steadily on. No other city in China will feel the effect of this invasion as will Shanghai.

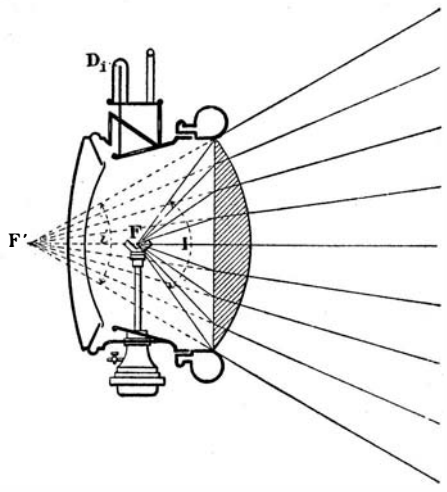


Fig. 2.—Diagram of Arrangement for Short-Range Illumination.

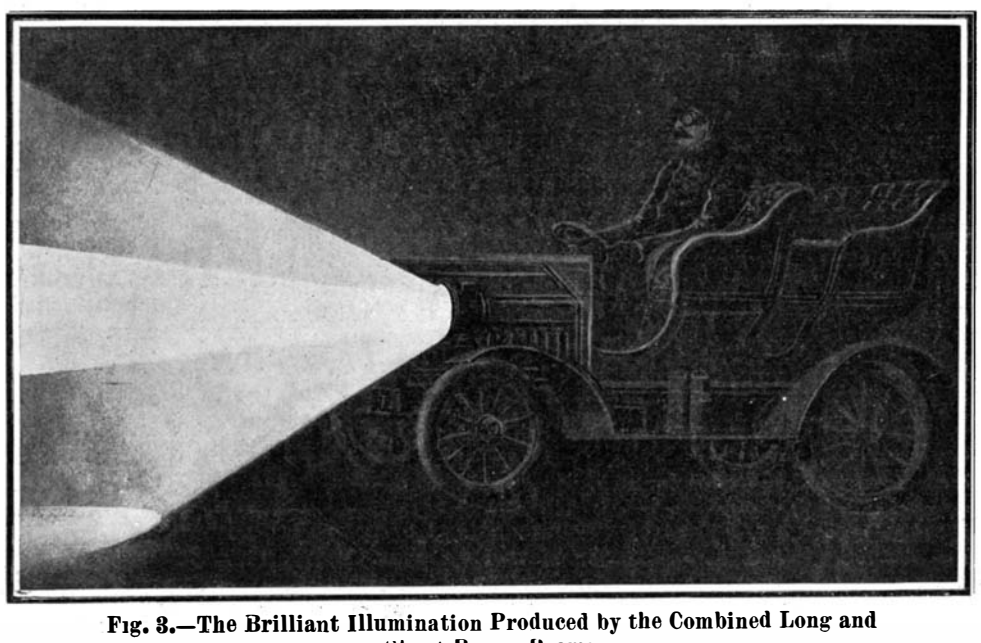


Fig. 3.—The Brilliant Illumination Produced by the Combined Long and Short Range Beams.

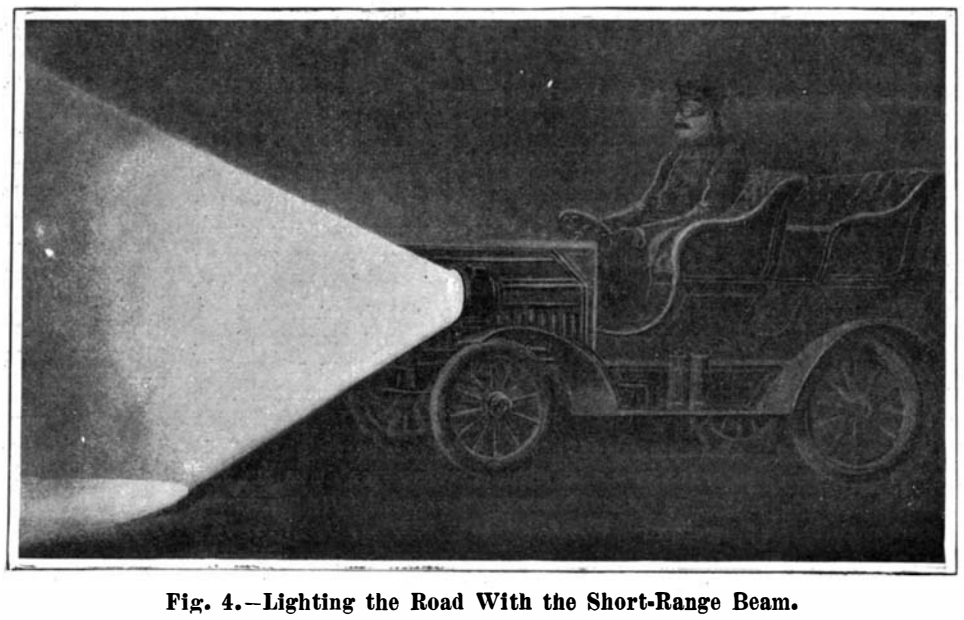


Fig. 4.—Lighting the Road With the Short-Range Beam.

A COMBINED LONG AND SHORT RANGE AUTOMOBILE SEARCHLIGHT

The highest recorded velocity of underground water is said to be 144 feet in twenty-four hours. The new record is for water flowing through gravel near Tucson, Arizona. The observations were made during the last Christmas holidays by Mr. H. C. Wolff, of the Department of Mathematics of the University of Wisconsin.

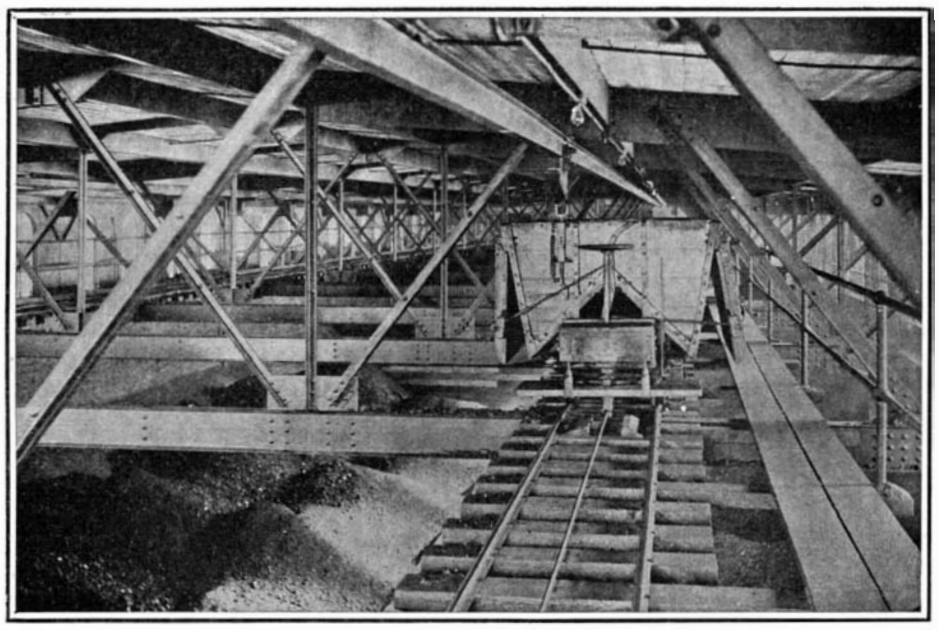
PENNSYLVANIA RAILROAD'S EXTENSION TO NEW YORK AND LONG ISLAND.—THE LONG ISLAND CITY POWER STATION.—I.

The Pennsylvania Railroad Company has had under consideration for a number of years plans for establishing a terminal for its lines on Manhattan Island. The earliest of these contemplated a bridge over the Hudson River, with elevated approaches and terminal in the city of New York. The demonstration that electric traction was practicable for heavy train units made possible, however, an entrance by means of tunnels, which would enable the adoption of a well-rounded-out plan for a terminal, which would embrace not only the Pennsylvania Railroad main line business, but through connection with New England and the railroad system on Long Island. The announcement that the Pennsylvania Railroad Company proposed to enter New York city was made in May, 1902, and since that date the project in all its features has been actively under way.

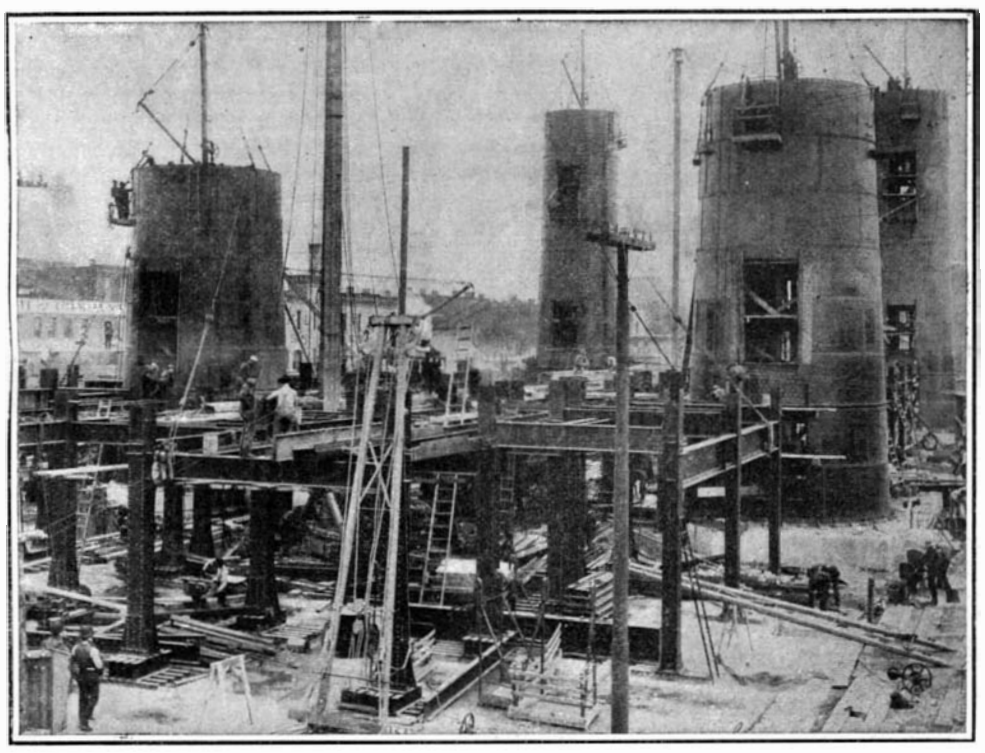
It is the purpose of the present series of articles to describe the progressive development of the terminal plans in their transportation, engineering, and architectural features, the present article being a description of the first unit in the construction, which has been completed in operative condition, namely, the Long Island City power house. Other articles will follow as rapidly as they are prepared and as the development of the plans warrants.

Two companies have been incorporated through which the Pennsylvania Railroad Company is carrying on its New York extension work. One of these, the Pennsylvania, New Jersey & New York Railroad Company, will build all of that portion of the tunnel and approaches in the State of New Jersey and extending under the Hudson River to the boundary line of the States of New Jersey and New York; from this boundary the other, the Pennsylvania, New York & Long Island Railroad Company, will construct the tunnels, terminal station, and yards on Manhattan Island, under the East River, and in Long Island City. The officers of these companies are officers of the Pennsylvania Railroad Company, the president being Mr. A. J. Cassatt.

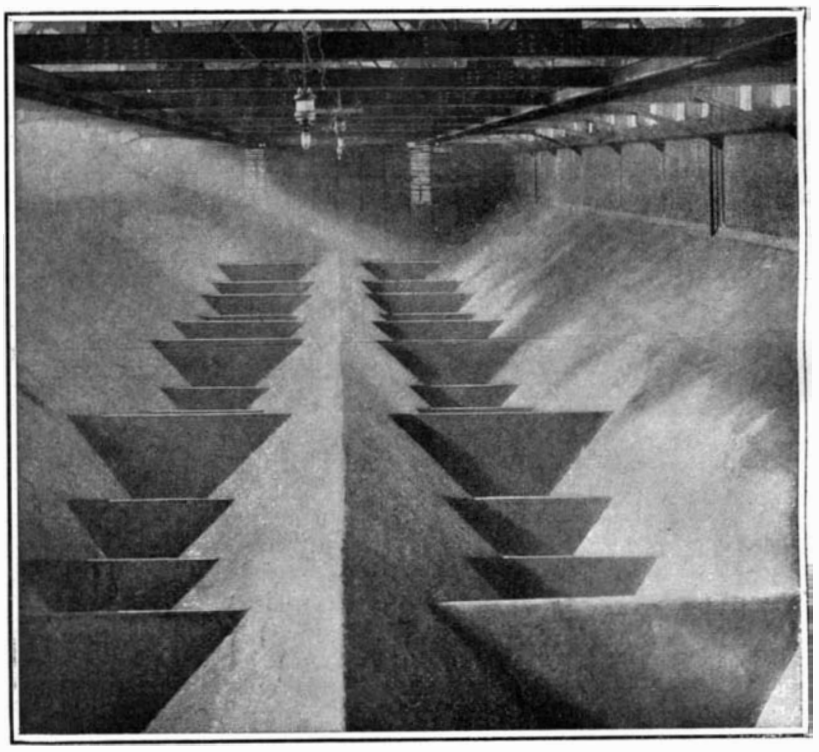
The tunnel work proper is divided into two parts; the East River Division being under the direct charge of Mr. Alfred Noble, chief engineer, and the North River Division under the direct charge of Mr. Charles M. Jacobs, chief engineer; the general railroad facilities and the electrical and mechanical features of the railroad and terminal are under the charge of Mr. George Gibbs, chief engineer of electric traction. These three officials, together with Brigadier-General Charles W. Raymond, chairman, constitute a board of engineers, to whom the general engineering features of the whole plan are confided. In addition, advisory committees consisting of officers of the road have been appointed to pass upon and work out the special problems relating to the required railway facilities, and pass upon the adequacy of the operating features as developed by the labors of the



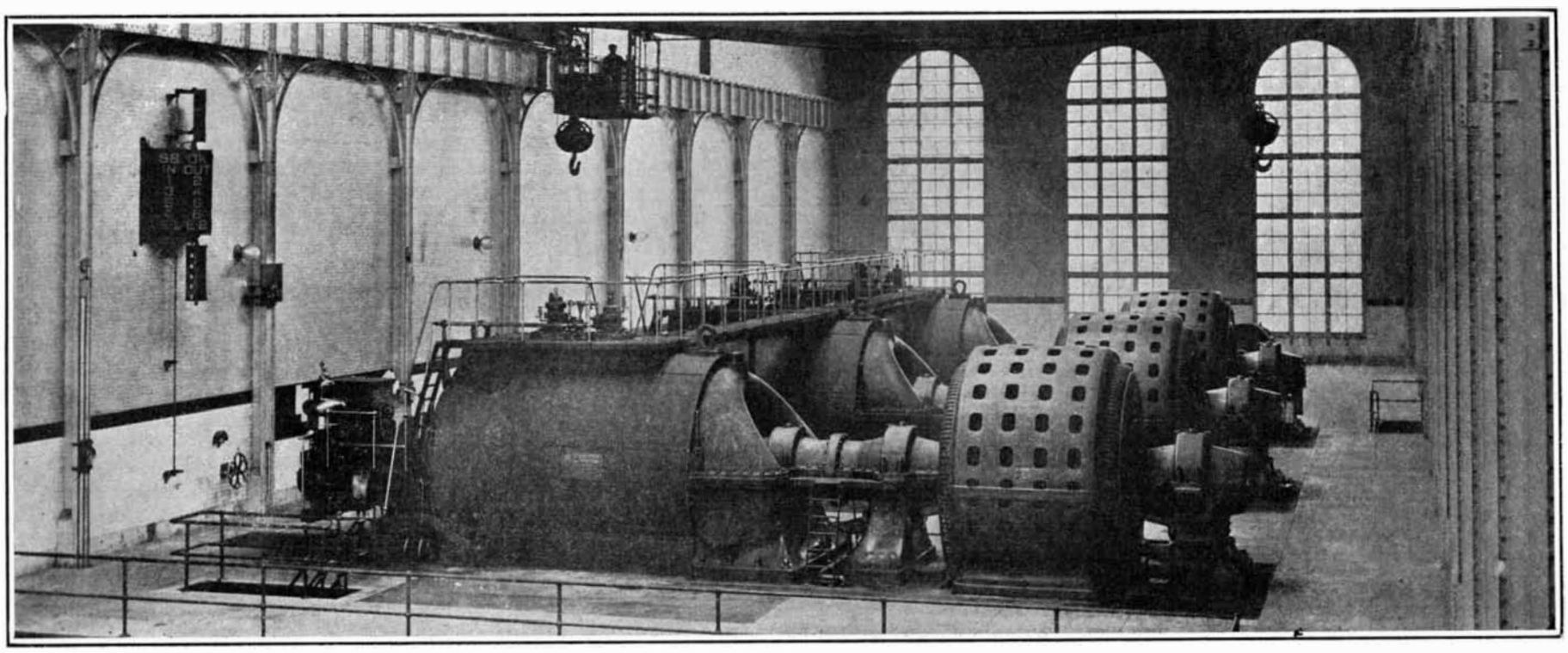
View in Coal Bin, Above Boiler House, Showing Cable Railway and Coal Car Ready to Dump Coal into Bin.



Steel Framework and Stacks in Process of Erection.



Interior of Coal Bin, Showing General Appearance of Pockets.



Interior of Engine House, Showing Three 5,500-Kilowatt Turbo-Generators.

LONG ISLAND CITY POWER STATION OF THE PENNSYLVANIA RAILROAD'S EXTENSION TO NEW YORK AND LONG ISLAND.

various departmental bodies. Messrs. Westinghouse, Church, Kerr & Co. have been selected as engineers and contractors for the electrical and mechanical engineering, acting under the supervision of the chief engineer of electric traction.

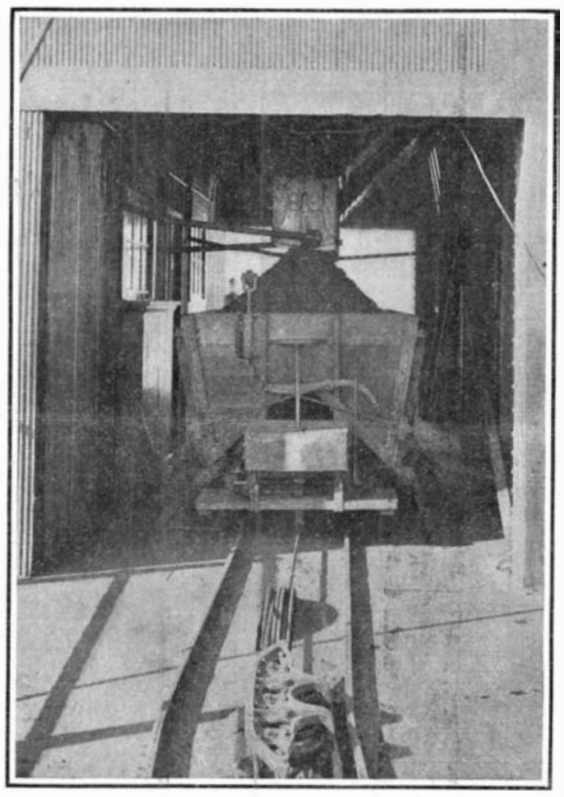
The Power House.—The power house building, designed by Messrs. McKim, Mead & White, is located on the Long Island shore of the East River, upon a rectangular block which extends 200 feet north and south, and parallel with the river, on Front Street and on West Avenue, and extends 500 feet in depth along Third and Fourth Streets. Although the immediate call for power does not necessitate the erection of a plant covering this whole area, the adopted design will permit the ultimate erection of a building capable of accommodating fourteen 5,500-kilowatt generating units, aggregating, in the total, 105,000 electrical horsepower. The present building has capacity for half this amount of machinery. A unit size of 5,500 kilowatts was adopted, because at the time this sation was designed, the largest turbo-generator that had been standardized was of that capacity. The first demand for power for the Long Island Railroad electrification called for the service of three of these units, and we present an illustration showing these units in place.

Foundations.—In view of the heavy concentration of loads involved in a power house of this character, it was decided to secure a uniform reaction over the whole area of the building by the use of a heavy, monolithic, concrete mass, overlaid upon uniformly spaced piling driven everywhere to refusal. Piles from 30 to 35 feet in length were driven on centers that averaged 2 feet 4 inches over the entire area. The total number of piles required was 9,115, the average designed load being 12 tons per pile. Cut-off was determined at 2 feet 6 inches below high-water level in a water-bearing stratum of river mud. The concrete cap overlying the piling is 6 feet 6 inches in thickness, while underneath the four great stacks the thickness has been increased to 8 feet 6 inches. Spruce piles, varying in length from 25 to 40 feet, were used. They were driven to refusal with a 2,000-pound hammer, falling 18 to 20 feet. There were as many as eight pile drivers at work at one time, the greatest number of piles driven in one day being 232, while as many as 83 were driven by one driver in one day.

The Coal Tower and Ash-Handling Structure.—As one approaches the power station from the water, the most striking feature is the lofty coal-handling tower and the bridges leading thence to the boiler house. This structure stands upon the coal dock and reaches to a height of 170 feet. At the height of 163 feet a steel hoisting boom projects 43½ feet over the slip. The boom, tower, bridge, and a lofty brick structure extending from the ground level to the bridge not far from the power house, constitute a most complete and efficient plant for the transfer of the coal from the river to the coal pockets in the boiler house, and for removing the ashes from the boiler house to the railroad cars. The tower consists essentially of four heavy box columns, thoroughly braced in all directions. The hoisting apparatus is located on a floor 25 feet above the dock in an inclosed engine room within the tower. The upper third of the tower above the level of the cable railway carries the hoisting boom before mentioned, the receiving hopper, coal crushing and weighing apparatus, and the cable railway machinery. The upper third of the tower for about 34 feet above the cable railway is inclosed, forming a two-story house, on the lower floor of which is the weighing mechanism and the engine for driving the crushing machinery and cable railway, and on the upper floor the crusher. Over the crusher is the heavy steel-plate receiving hopper. The distance from the coal tower to the boiler house, about 500 feet, is covered by four bridge spans which support the cable railway, and beneath it, and directly across Front Street, is the rectangular structure of the ash bin, to which ashes are delivered through another bridge leading to the boiler house at an elevation of 69 feet above the street. The ashes are carried by a telpherage system, which picks up the ash buckets from the ash cars in the boiler-room basement, carries them over this bridge into the tower, where they are dumped in a large bin capable of holding 300 tons of ashes. The material is dumped through grates in the bottom of the bin into gondola cars standing on the track below.

The hoisting tower has been designed with a view to "one-man" operation, and the control of the whole system has been concentrated on a single floor at an elevation only a short distance above the coal barges from which the unloading is being done. By this arrangement the objectionable features of the old method of placing the operator at the level of the boom are avoided. The coal is hoisted by a two-ton clamshell bucket to the boom, run into the tower over trolley tracks on the bottom chords of the boom, dumped into the hopper, crushed, automatically weighed, dumped into cable cars, run by gravity into the boiler house, and finally dumped at the desired position into the great 5,200-ton coal pocket. The crusher has a capacity of about 400 tons in five hours. The tracks are arranged in a loop between the tower and boiler house, and the whole system is capable of handling coal at the rate of 150 tons per hour when operating twenty-nine two-ton cars at a speed of 180 feet per minute around a track loop which is approximately 2,500 feet in length.

Boiler Plants.—The boiler plant for the Long Island power station consists of thirty-two Babcock & Wilcox water-tube boilers set in batteries of two boilers each, eight batteries on the first floor and eight batteries on the second floor, immediately over the former. They are equally distributed on each side of the boiler house, with an 18-foot space for firing between boiler fronts. The working pressure is 200 pounds to the square inch, and the total effective heating surface of each boiler is 5,243 square feet. Each boiler also carries an internal superheater capable of superheating the output of the boiler 200 deg. Fah. at 200 pounds pressure, the total superheating surface amounting to 1,116 square feet. Each boiler is fitted with one of the well-known Roney mechanical stokers. Directly behind the boilers and over the flues are the economizers, which are designed for 250 pounds pressure. By the use of these economizers the hot gases are so reduced in temperature that they enter the base of the stacks at about 350 deg. Fah. temperature. The four lofty stacks which constitute a striking feature in the photographs of the power plant are built of steel and are entirely self-supported. They extend 275 feet above the base. The internal diameter of the straight portion is 17 feet 10 inches at the bottom and 16 feet at the top. They are lined throughout with brick, whose weight is transferred at intervals of 20 feet to the steel shell by means of Z-bars riveted to the shell.



Loading Platform in Coal Tower.

The outside shell decreases gradually from ½ inch in thickness at the bottom to 5-16 inch at the top. The space between the shell and the brick lining is grouted full of cement mortar. The stack is fastened down to its base by a segmental cast-iron ring 23 feet in diameter, which is held down by twenty 3-inch anchor bolts, that pass through a grillage in the bottom of the concrete foundation.

The Turbo-Generator Plant.—No attempt has been made to give the main building of the power station any elaborate architectural treatment, the general view, as shown in our photographs, showing great simplicity and quiet dignity of design. Any architectural character that it possesses is determined by the strictly engineering necessities of the case, and it will be noticed at once that it divides itself into two main portions, the taller section being the boiler house, and the other the engine house. The only feature which can be considered to be ornamental is the name "Pennsylvania," inscribed across the parapet of the engine house in neat terra-cotta letters. The boiler house proper is 82 feet high at the top of the parapet, and 118 feet to the parapet of the superimposed coal pocket inclosure. The interior height of the engine room from floor to trusses is 40 feet, while the exterior height of the engine room building is 70 feet, measured from the ground to the top of the parapet. The over-all dimensions of the present building are 200 feet by 262 feet, although, as already stated, its ultimate dimensions will be 200 feet by 500 feet. At present the engine room contains three 5,500-kilowatt Westinghouse-Parsons, single-flow steam turbines direct-connected to three-phase, 11,000-volt generators of the revolving field type. The rating of the turbines above given is on a basis of 175 pounds steam pressure, 27½ inches vacuum, and a speed of 750 revolutions per minute.

We have so frequently described this type of generator, that it is sufficient here to say that the steam flows parallel with the shaft through a series of alternating stationary and moving blades, the size of the blades and the intervals between them increasing gradually from the admission to the exhaust end of the turbines. The smaller blades are made from special bronze, the larger ones from steel. They are all originally rolled in long rods of a general crescent cross section then sawed into the proper lengths, set in grooves in the drum and cylinder, and calked securely in place. The length of each turbo-generator unit is 47 feet, its width 13 feet, and its height 14 feet to the top of the gallery ring. Compare this with the dimensions of a four-cylinder piston engine of equal capacity, and its huge 32-foot generator, which together would call for a floor space 55 feet long by 35 feet wide, and which would tower 35 feet above the floor. The turbine is governed by means of a "fluttering" main poppet valve. Steam enters, not in a continuous blast, but in puffs, the duration of which is controlled by the amplitude of vibration of a little oscillating pilot valve actuated by levers and worm gearing from the main shaft. The advantages of this intermittent action are that the turbine is always using boiler pressure steam, that the admission valve cannot get stuck, and that the continual movement of the governor balls in and out prevents wear.

A separate condenser is provided for each turbine. They are of the Alberger counter-current surface type, and each has 20,000 square feet of cooling surface. A somewhat unusual feature is the use of a small booster generator to prevent electrolytic corrosion of the condensing tubes.

Turbo-Generators.—It is one of the great advantages of the steam turbine as an electrical drive that because of its high speed of revolution there is a great reduction in the size, weight, and cost of the direct-driven generators. The "engine" type of generator is an enormous affair, 42 feet in extreme diameter and 445 tons in weight, running at 75 revolutions per minute, whereas the turbo type of the same capacity, running at 750 revolutions, is only 13 feet in extreme diameter, and weighs very much less. The armature is stationary and is inclosed in a large cylindrical yoke of cast iron. The revolving field consists of a four-pole structure formed out of solid steel disks milled to receive the winding. It is about 6 feet 8¼ inches in diameter and about 6 feet long. Three separate sources are provided for exciting the fields of the main generators, namely, two steam-driven exciters, one motor-driven exciter, and a storage battery. In a later article we shall deal with details of the electrical plant, which, because of limitations of space, are excluded from the present article. The station was planned and built by Westinghouse, Church, Kerr & Co., engineers, for the Pennsylvania, New York & Long Island Railroad Company, which is the organization through which the Pennsylvania Railroad is carrying on its New York extension work. The design and construction were under the charge of Mr. George Gibbs, chief engineer of electric traction of the road, and under the general supervision of the Mechanical and Electrical Advisory Committee, New York Extension, a committee composed of officers of the Pennsylvania Railroad Company.

A New Arrangement for Enabling Spectators to Follow the Words and Music at the Opera.

A decidedly novel scheme for placing before the spectator the text of an opera libretto as it is being sung has lately been brought forward in Europe. In the upper part of the proscenium arch is arranged a screen upon which a magic lantern projects the line that is being sung. The text of the opera is arranged upon a transparent ribbon which is fed through the stereopticon by an electrically-operated apparatus under the control of the prompter, who changes the lines by pressing a button at the proper moment. This arrangement allows the spectator to tell at any moment just what is being sung by merely glancing upward at the illuminated screen. The new invention will doubtless prove a great aid to spectators and add considerably to their enjoyment.

The German naval authorities, according to the Cologne Gazette, have fixed the displacement of the latest type of torpedo boats at 570 tons, as against the 420 tons of S 131, the largest torpedo boat at present in the German navy. The new boats represent a considerable advance in several respects. They will have a more powerful gun equipment, greater speed, and light-armored protection for the engines and boilers. The speed will be 30 knots, as compared with the maximum of 27 knots hitherto attained. The armament will consist of four 5-centimeter (2-inch) and two 8.8-centimeter (3½-inch) quick-firing guns; hitherto only three 5-centimeter (2-inch) guns have been carried. The bunkers will be considerably enlarged, so that, in spite of the increased consumption of coal, the radius of action will be much increased.

Marconi and De Forest Wireless Litigation.

The United States Circuit Court for the Southern District of New York recently issued an injunction against the De Forest Wireless Telegraph Company as the result of a bill in equity filed by the Marconi Wireless Telegraph Company of America, alleging infringement of Marconi's fundamental patent issued July 13, 1897, and numbered 586,193.

In a very ably written opinion Judge Townsend reviews the state of the art previously to Marconi's first experiments, discusses the nature of Hertzian waves, and outlines the essentials of a commercial wireless telegraph installation. The injunction restrained the infringement of claims 3 and 5 of the Marconi patent. Claim 3, the broader of the two, reads as follows:

"3. The combination, in an apparatus for communicating electrical signals, of a spark-producer at the transmitting station, an earth connection to one end of the spark-producer, an insulated conductor connected to the other end, an imperfect electrical contact at the receiving station, an earth connection to one end of the contact, an insulated conductor connected to the other end, and a circuit through the contact, substantially as and for the purpose described."

The specific infringement complained of consisted in the installation and use by the De Forest Wireless Telegraph Company of its stations between New York city and Staten Island. In this particular installation the transmitting and receiving stations were equipped with high vertical wires insulated at the top. At the transmitting station were a dynamo, directly producing an alternating current, primary and secondary coils, Morse telegraph key, a spark-gap, and a condenser, most valuable adjunct to the practical operation of wireless telegraphy, but not directly involved in the suit. The high-frequency oscillations created or produced, as in the Marconi system, were radiated from the vertical wires of the transmitter and, traveling across to the receiver, impinged upon its wires and traveled down to a so-called detector or variable resistance conductor, closely corresponding in function and result with the coherer of Marconi's patent, and alleged to be its equivalent.

One of the main points at issue in the suit was the use of insulated conductors, described and illustrated in Marconi's patent as metallic plates suspended by poles on wires and insulated from earth. The conductors of the 1898 system of Marconi are aerial wires insulated at the top, but connected with the earth at the bottom.

Both complainant and defendant, at the time the bill was filed, used a construction where the conductors were insulated at the top, but only interrupted or obstructed as to the earth connection at the bottom. The complainant contended that defendant admitted that it is immaterial whether the aerial is insulated from the ground at the lower end. Dr. De Forest said that he preferred to employ earth connections because they permitted transmission to greater distances. Both sides agreed that the function of the earth was not satisfactorily understood; both agreed that such an earth connection is an advantage possibly due to a guiding and strengthening force to conduct the waves to the surface of the earth so that they may glide farther through the ether.

In this state of uncertainty as to the whole subject the court thought that Marconi should not be deprived of the benefit of his real invention upon any narrow limitation as to the earth connection or interruption at the lower end of the conductor, when it did not appear that even in the case of the spark-gap or tube filing obstruction the earth did not discharge the same functions as it is now supposed to discharge, and when presumably the question is merely one of degree, the strength being theoretically greater in degree where the earth connection is merely obstructed by a transformer.

The rather sensational press reports which gave to Judge Townsend's decision an exaggerated effect must be taken with the proverbial pinch of salt. The injunction is not directed against the present De Forest system or against the present American De Forest Wireless Telegraph Company. It is issued against a defunct De Forest company and against the use of an apparatus which, we are informed, was an experimental and discarded form of apparatus used but a short time in 1902. It is claimed that the apparatus enjoined has never been used by the present American De Forest Wireless Telegraph Company. Indeed, De Forest and Marconi are now engaged in patent infringement litigation which may continue for several years before the respective rights of the parties are decided by the courts.

Almost simultaneously with the granting of the injunction, there appeared in the Patent Office Gazette a disclaimer of the invention covered in claim 1 of the patent in suit. The patent had been reissued and claim 1 so broadened that its terms cover every form of imperfect contact in every possible kind of system for producing signals by means of Hertz oscillations. In view of the limitations imposed upon the Marconi coherer by the disclosures of Branly, Popoff, and Lodge, such a generic claim, much broader than those of the original patent for which it seems to have been substituted, should not have been permitted when the effect would be to enlarge the scope of the original invention.

In the original patent Marconi limited most of his claims to a combination in a receiver for electrical oscillations of his coherer, consisting of a tube and powder, and means for shaking the powder. But inasmuch as this had been disclosed by prior publications, he applied for the reissue, and by claim 1 attempted to cover not merely the coherer of his former claims or any such coherer in a receiver, or a coherer with means for shaking the powder therein, but every form of imperfect contact device, previously disclosed by others or which might be thereafter discovered, whenever combined with any electrical signal apparatus using Hertz oscillations. This claim, if allowed, would apparently cover the prior devices of Lodge and Popoff, the latter of which is claimed to have necessitated the disclaimer and reissue. Hence the injunction did not apply to claim 1, and hence the disclaimer.

Decomposition of Dust upon Heated Bodies.

In heated rooms we often perceive an unpleasant tickling odor, which irritates the mucous membrane of the larynx and causes coughing. It comes from burnt and decomposed dust, from which ammonia and other hurtful substances arise. This decomposition, which occurs only when the dust is damp, is most frequently found with the usual iron stoves whose sides easily become red-hot, in consequence of which the particles of dust lodging on the stove burn and vitiate the air. But the hot-air flues of furnaces also easily become overheated, in consequence of which dust lodging burns and the products of the burning mingle with the air. The Freie Deutsche Presse says that Prof. Esmarch, of Hanover, "found in his investigations that, on small heated bodies not above 70 deg. C. in temperature, the dust is always decomposed. On ground floors, indeed (where the air rushing in directly from the street is mingled with the dust from the horses' evacuations), the bad odor already begins to be perceptible when the surfaces are heated to 65 deg. Notable is the observation made by Nussbaum, that dust which proceeds from air artificially saturated with steam evolves vapors more evil-smelling and irritating than the dust from ordinary air. In order to prevent the vitiation of the air in a room, the heated surfaces must not be heated over 65 deg. to 70 deg., and every further addition of moisture to the air is to be avoided. Of course, the heated bodies themselves are to be kept scrupulously clean and are to be frequently washed off. But this cleansing does not fully protect from the decomposition of dust, because the air sweeping past the heated bodies always brings dust upon the heated surfaces again. In furnace heating, the air must be carefully kept free of dust, i. e., be filtered."

Gentian as a Cure for Malaria.

The root of gentian, often used as a tonic, is considered in many malarial countries a remedy against intermittent fever. Especially is this the case in Corsica in that section of the island near the town of Aleria, which is infested with malaria. The inhabitants recently protested violently against the introduction of quinine on the part of the medical authorities, declaring that they would not abandon the remedy which had been used among the islanders for centuries, namely, the gentian root either powdered or simply masticated.

Tancret declares that he has extracted from this root a hitherto unknown substance, which belongs to the chemical classification of glucoses. This he calls genziomcrina, and experiments in the laboratory prove that it possesses the same deleterious action upon the malaria bacillus at does quinine. Here, then, we have another example of how popular instinct often anticipates with a certain sureness the discoveries of science.

The Current Supplement.

An excellent article on the Isthmus of Tehuantepec and its interoceanic railway opens the current Supplement, No. 1579. John F. Wallace, ex-Chief Engineer of the Panama Canal, gives his views on the way the canal ought to be constructed, and makes a strong plea for the sea-level canal. J. E. Petavel's report on the pressure of high explosives is concluded. "Some Notes on Fuel Briquetting in America" is the title of a very good article by Clarence M. Barber. F. F. Robin tells how filled capsules are made. Prof. Shaw's electric micrometer for measuring the seventy-millionth part of an inch is fully described by the English correspondent of the Scientific American. Something of the wonderful sensitiveness and accuracy of this instrument may be gathered from the fact that it must be used some twelve feet below the street level at night time, when all traffic and factory work have been suspended. A very good history of the marine turbine is published.

Correspondence.

The Soaring of Birds.

To the Editor of the Scientific American:

I have evolved a theory concerning bird flight which seems to be novel, and as this question is apparently still open for discussion, I have decided to submit the same to your readers.

A close observer of bird life knows that there must be some motive power other than that provided by the wings. While the air-current theory for soaring birds, and the wing theory for those that work the wings up and down, partially answer, how about those that almost seem to neglect spreading the wings when starting from a perch and then fly in graceful curves, downward and upward alternately, closing and opening the wings with each curve? In extending the wings the contraction of the muscles of the breast counterpulls against the shoulder joints, which are so formed as to create a vacuum or a partial vacuum. This, perhaps, may be regarded as the center of gravity; and thus, the air pressure being the same in all directions, the speed is acquired by the weight of the body back of the shoulders, less the weight forward of that point.

That the muscles of a flying bird's breast are vigorously exercised is shown by the dark color, while the breast of a domestic fowl is white.

Greenfield, Iowa. Mrs. R. H. Lovely.

The Mürren Railway.

To the Editor of the Scientific American:

The issue of February 24, 1906, No. 8, of the Scientific American contains an article about the Mürren Railway.

Please allow me to give you some other information concerning that line.

The Mürren Railway, on its section Lauterbrunnen-Grütsch Alp, was opened to traffic on August 14, 1891. It was operated on the water-counterweight system, as described in the article mentioned.

Some years ago, the number of travelers in Switzerland increasing very rapidly, it was found necessary to enlarge the capacity of the line, and in 1902 it was electrified. The station Grütsch Alp was equipped with electro-motors.

It turns around two large pulleys, one at each station. The cars are attached to the cable, and by this method are very accurately balanced, so that the emptying of the tank during the descent is not necessary. The line is 1,695 meters long, and the journey takes fifteen minutes.

The large front-page engraving in the same issue, that you give as " A Turnout on the Mürren Railway," is *not* on that line, but on the Salève electric railway, near Geneva, Switzerland, but on French territory. It is built on the third-rail system, which is clearly shown in the photograph. Edg. Rossiaud.

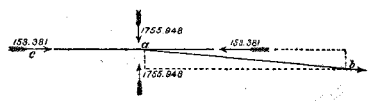
Zurich, Switzerland, March 14, 1906.

The Theory of the Hydroplane.

To the Editor of the Scientific American:

The paper by Ernest Archdeacon, "Sixty Miles an Hour on the Water," in your issue of March 3, is both interesting and important.

His statement, "the theory of the hydroplane, which is, moreover, identical with that of the aeroplane," is entirely correct. But the suceeding statement, that "the draft of water becomes zero, and the displacement also," contains error. The displacement can never become zero so long as the hydroplane has weight. The diagram of both the hydroplane and aeroplane is herewith given, with Count de Lambert's weight of 1,763 pounds. The resistance to motion in each case is fluid pressure and skin friction, the direction of both being fixed by the law of fluids, the first being normal to the plane, and the second along the plane, and for those reasons at right angles to each other.



Numerical values are given for an inclination of 5 degrees, and the sine and cosine of the angle are used in the usual way. Gravity being oblique to both reactions, is resolved into factors, 1,755.948 pounds, making normal pressure, and 153.381 pounds along the surface. Then the motive power is applied on *c*, canceling the small factor, and enough more to overcome skin friction, which is practically negligible. The diagram represents the activity at the instant of uniform motion, when inertia of mass no longer exists. *a b* is a resultant of two motions, and no energy is discharged on that line. The motive power of the boat has nothing to do with normal motion or displacement, since it is perpendicular to it, 90 degrees away, and cannot possibly act upon it.

I can see no reason why a hydroplane could not be urged to a velocity on water equal to that of an automobile on land. Resistance of air need be no greater in one case than in the other. I. Lancaster.

Fairhope, Ala., March 7, 1906.

HOW ARTIFICIAL TEETH ARE MADE.

BY HARRY DILLON JONES.

Among the many industries in which America now leads the world is that of making artificial teeth. The lowest quantity of artificial teeth continually kept in stock by one of the Philadelphia factories is between eight and nine millions. The shipments are made to every country in the civilized world, and even to the interior of Africa and remote parts of the Orient.

Once every dentist made his own supplies in his laboratory. Now all artificial teeth are manufactured in great central factories, and shipped to distributing centers, where they can be matched and fitted to any jaws from the ready-made stock.

The growth of the artificial teeth industry is one of the most important of scientific advances. At one time teeth were made from various ivories (elephant and hippopotamus tusk being the favorites), from the teeth of some animals, and also from human teeth. None of these were satisfactory. The ivory of the elephant and hippopotamus tusk was not impervious to the action of the decomposing agents, and soon became objectionable. The human teeth were better protected by enamel, but the mere thought of using such teeth was enough to make one shudder. In time from this crude beginning the porcelain or, as it was sometimes called, the "incorruptible" tooth was evolved, and this is in use to-day.

With the invention of porcelain makers were able to do that which they never could with the old ivory teeth, namely, to color them to match the real teeth, and thus diminish the chance of their detection in the mouth. In the great factories where teeth are now turned out by the million, labor of the most skilled kind is employed to make the teeth, match them, and assemble them properly for the use of the customer. Women perform an important part of this work, for their keen sense of touch enables them to quickly detect flaws in the finished article, and their superior education in the matter of matching colors makes it possible for them to detect a variation of the slightest shade in the teeth, so that teeth that to a man may seem perfectly matched will to a woman's eyes show slight differences that are sufficient to impair their value.

But before the finished teeth are submitted to the keen eyes of the girl examiners for the final test, they have to pass through a succession of processes. Porcelain teeth are composed of two parts, one being the body and the other the enamel. The first step in the making of the tooth is the mixing of the ingredients for the porcelain. This is done by experienced chemists, for the material must be flawless. The body comprises various components, for each manufacturer has his own formula, and these of course are factory secrets. Broadly, however, it may be said that the "body" of the artificial tooth is made from feldspar (usually called spar), silex, and kaolin. The enamel is made from feldspar with a little silex and coloring matter. For the information of the exacting reader, it may be said that the feldspar is composed of silica, alumina, potash, lime, and oxide of iron. It is found in various parts of the United States, near Boston, Philadelphia, Wilmington, Del., and elsewhere. Kaolin is merely the Chinese name for porcelain clay. It is formed by the decomposition of the feldspar of granite hills, which washes down into the valleys below. It can be obtained in various parts of the country.

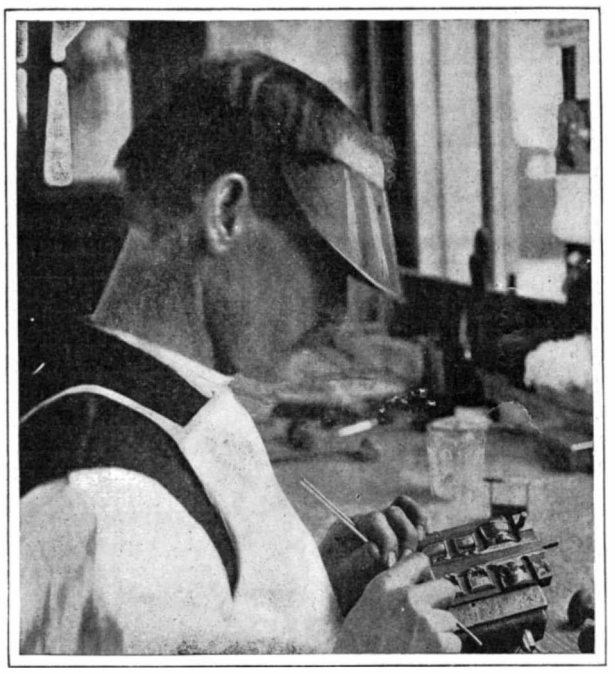
The coloring materials used in the making of the teeth are gold and its oxides; purple of Cassius, oxide of manganese, oxide of cobalt, platina sponge or filings, oxide of titanium, oxide of silver, and oxide of uranium.

The material for the body of the teeth is first heated to a white heat and thrown into cold water. It is then broken into small pieces, freed from impurities and ground in a mortar till it will pass through a sieve of No. 9 bolting cloth. When the material has been finally treated and fused and mixed with silex and kaolin, it is of a semi-translucent appearance. With this material the skilled workers in the factory mold the teeth to the desired shape. When new teeth are ordered—and there are fashions in teeth as well as in every other line of commerce—it is necessary first to make a mold. The greatest care is taken by hand workers in the preparation of these molds, which must be shaped and tooled with the utmost precision, in order that the teeth may conform to the style desired. In one of the big factories the writer was shown an immense fireproof room in which were kept the molds of hundreds of different varieties of teeth.

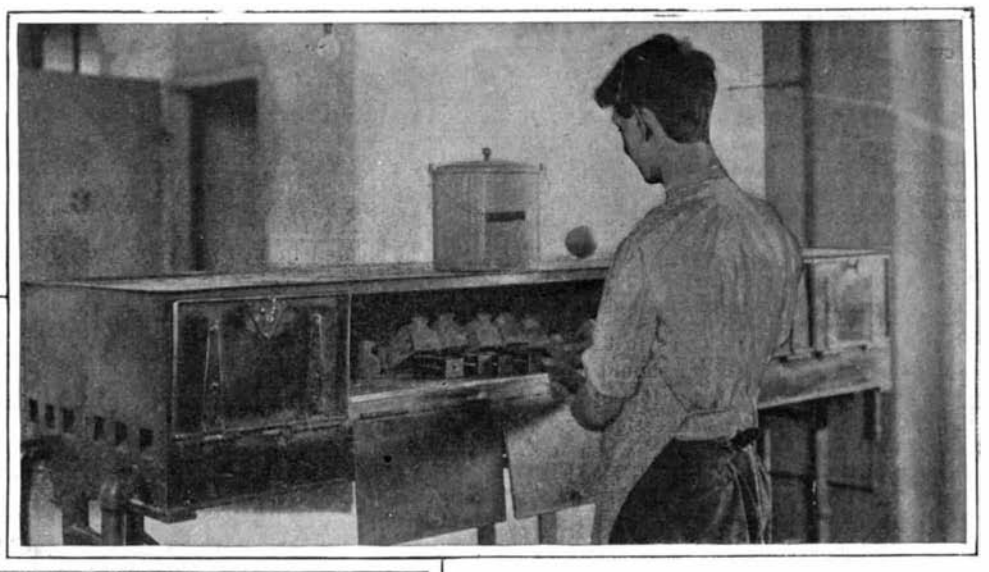
When the composition for the body of the tooth has been placed in the mold, the cover is shut down, and it is put aside in readiness for the firing. Workmen are busy all day long, in rows, filling the molds with composition and placing them aside for the men who go around collecting them for the ovens. The operators at the ovens bake the composition to the proper hardness, and then send them to the trimming department. Here workmen take the hundreds of molds that pass through the ovens daily, turn out the hardened teeth, trim off the rough edges, and shape them for the second baking. When taken from the furnace, where they receive a final and prolonged baking at a tremendous heat, the teeth are ready for examination and the last touches by the women workers. After examining for defects and discarding the teeth that show to their practised touch and quick eye the presence of some slight flaw, the girls polish and finish the teeth ready for shipment.

There are faddists in teeth as in everything else. Sometimes a woman will order a set of teeth of the kind she has seen and admired in some one else. In most cases it is not difficult to match these teeth from the twenty-five shades of color that the big factories carry in stock. But occasionally there are orders for what are known as "freak teeth," teeth which have a peculiar color or a shape so different from any teeth before manufactured that it takes days of experimenting with chemicals and molds to produce the desired match. On the other hand, men frequently want teeth to match their own tobacco-stained teeth. Then the coloring process has to be of the expert order, to prevent anyone detecting the presence of a false tooth.

Final Inspection for Defects.



Making the Molds.



The Molds Are Hardened by Baking.

Shaping the Molds.

Examining Finished Teeth for Flaws.

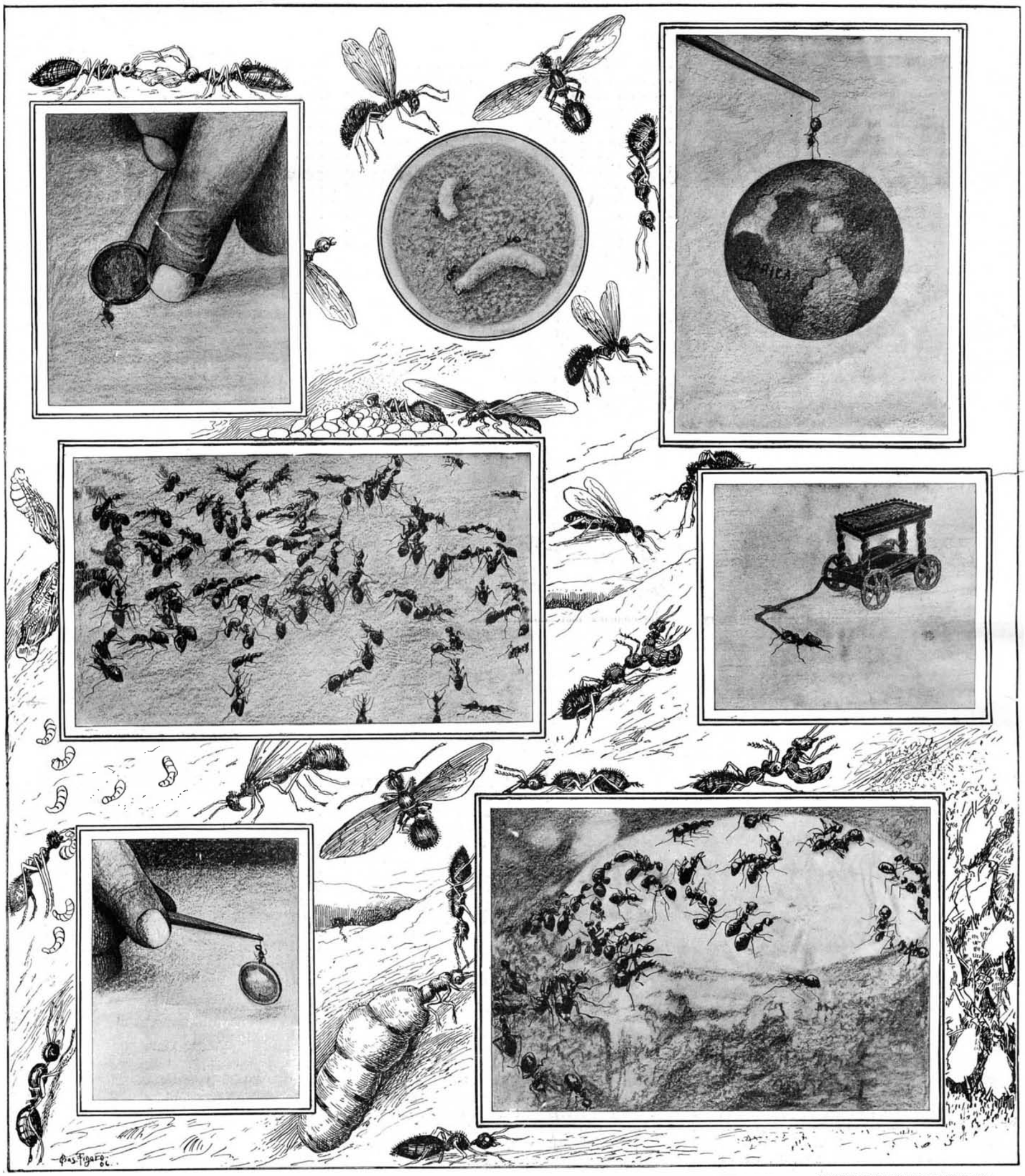
HOW ARTIFICIAL TEETH ARE MADE.

According to information gathered by the American Iron and Steel Association, seventeen blast furnaces were in course of erection in the United States at the close of 1905, and three furnaces were being rebuilt. Of the furnaces building two were in New York, four were in Pennsylvania, one was in Tennessee, two were in Alabama, three were in Ohio, two were in Illinois, one was in Michigan, one was in Wisconsin, and one was in Colorado. With the exception of the Michigan furnace all of these furnaces, when completed, will use coke or mixed anthracite coal and coke for fuel. The Michigan furnace will use charcoal.

ANTS AND THEIR WAYS.

The ant, despite its biblical reputation for industry, has characteristics which are not altogether admirable, and which prevent it from posing as a general good example for sluggards to follow. For instance, it is well known that certain species of ants are most determined and ferocious slave hunters and slave keepers, and that they make destructive attacks on neighboring and less powerful colonies, for the sole purpose of carrying off the infant members of these into bondage. It is true that the slaves are afterward both well treated and protected, though it is doubtful whether this is done because of their value as chattels, or because the masters recognize the ethical iniquity of the situation and thus try to ameliorate it. Besides this, ants are not merely warlike, they are positively "spoiling for a fight," and often support in their communities armies of idle and otherwise useless fighters, not only for defense, but for the purpose of depredatory incursions upon their neighbors as well. As we are to-day painfully trying to point the way to general disarmament and universal arbitration, it would hardly do to follow the little insect in this particular. Physical strength is no doubt valuable and pleasing, but if we attempted to emulate, comparatively, the ability of the ant in this direction, the result would be numberless unfortunate accidents, or the development of a race of muscular monstrosities.

The student of the life and habits of the ant is often astounded by the prodigious strength and activity displayed by the insects. Certain of the possibilities in the strength of an ant are graphically illustrated in the accompanying engraving. In one picture, an ant is shown supporting in the air a globe weighing eight hundred times its own weight. To understand exactly what this would mean if a man were to attempt a feat comparatively similar, we must imagine him suspended from a height by one leg and holding in his jaws a weight of nearly 130,000 pounds, or, say, a 75-ton locomotive, if we assume that the man weighs 160 pounds. The mere contemplation of what such strength represents renders comment unnecessary, and



Redrawn from Illustrated London News.

Grasping a coin preparatory to lifting it.
A battle for sugar.
Lifting a coin. The ant hangs by one leg from a pair of forceps.

Ant warfare. Fighting and capturing caterpillars.

An ant lifting a globe eight hundred times its own weight.
Ant dragging thirteen hundred times its own weight.
Feeding on honey.

THE WONDERFUL POWERS OF THE ANT.

it enables us to comprehend how these little creatures can perform such marvels of labor in the building of their great communistic dwellings and colonies.

In two other views an ant is shown first grasping a coin with its jaws, and then holding it while hanging from a pair of micro-forceps. The remarkable strength of the jaws is well illustrated by this performance, for the coin weighs over five hundred times as much as the insect itself. It is said that the natives of Colombia, South America, use the jaws of a certain species of indigenous ants for closing wounds. They induce the insects to bit the two lips of the wound, and thereupon sever the bodies from the heads, which then serve as a suture.

In another engraving there is shown an ant displaying its pulling power by dragging a little silver coach toward the nest. This coach has a weight some thirteen hundred times that of the insect, and if it were possible for a man to pull a hundred-ton railroad train, his labor would be commensurate with that of the ant. In dragging the weight up an incline, the ant wisely eases its toil by moving from side to side like a horse going uphill.

Ants are undoubtedly to be numbered among the fiercest fighters, not only of the insect world, but of all living creatures as well. So strong is their fighting instinct and tenacity of purpose, that if two of the soldiers have grappled, the hold is not released till one has succumbed. One of our illustrations shows a number of ants attacking and destroying two caterpillars. The caterpillar is often able to put up a stiff fight, and not infrequently a number of its little adversaries are killed, though in the end the caterpillar is invariably slaughtered and triumphantly dragged to the nest. Another of the engravings depicts a portion of a battlefield upon which the armies of two ant colonies are shown in mortal combat. The engagement has degenerated into a series of sanguinary individual fights, and large numbers of dead and wounded are shown scattered about the scene of action. The other of the larger illustrations does not show a similar battle, but is merely illustrative of the swarming of a number of ants upon a bit of honey, of which they are inordinately fond. Sweets in general are highly prized by these insects, and it is known that certain species of ants keep *Aphides* (small louse-like insects) in their colonies, and milk these of a sweet fluid which they secrete. In other words, ants keep cows.

The "agricultural ant" myth has apparently been in part exploded, for it has been shown that ants do not plant grass seeds or "ant-rice" for a harvest. It is probable that the error was due to the fact that the sprouted seeds stored up, and then cast away as inedible, take root, and thus form a partial circle of tall grass around the nest. It has, however, been recently shown that certain South American species of *Atta* cut and bring pieces of leaves into their cellars and comminute these till they form a pulp, which is heaped up and soon becomes invaded by a fungus which is carefully cultivated and used as food.

Sawmill Refuse as Fuel.

The manufacture of lumber is the chief industry of Portland, says O. B. Coldwell in an article on the value of sawmill refuse as a fuel, published in the Journal of Electricity. The daily output of sawdust amounts to 568 wagon-loads. The sawmills all use this by-product for steam-raising purposes, but much remains over, and this is sold. The Portland General Electric Company uses from 100 to 150 loads of this refuse per 24 hours in its boiler plant, this being burnt in a Dutch-oven type of furnace, built out in front of the boilers. These are entirely filled with the fuel to reduce air leakage. A number of evaporative tests are given to show the value of this refuse for steam-raising purposes. The cost of fuel per kilowatt-hour in these tests varied from 0.57 to 0.83 cent, as compared with 0.97 cent, when oil was employed. Oil is displacing coal in California on account of its lower cost, but in Portland it will have to compete with sawmill refuse, and as these comparative trial tests show, the refuse is the cheaper fuel for steam-raising purposes.

ELECTRIC TRACTION ON THE SIMPLON RAILWAY.

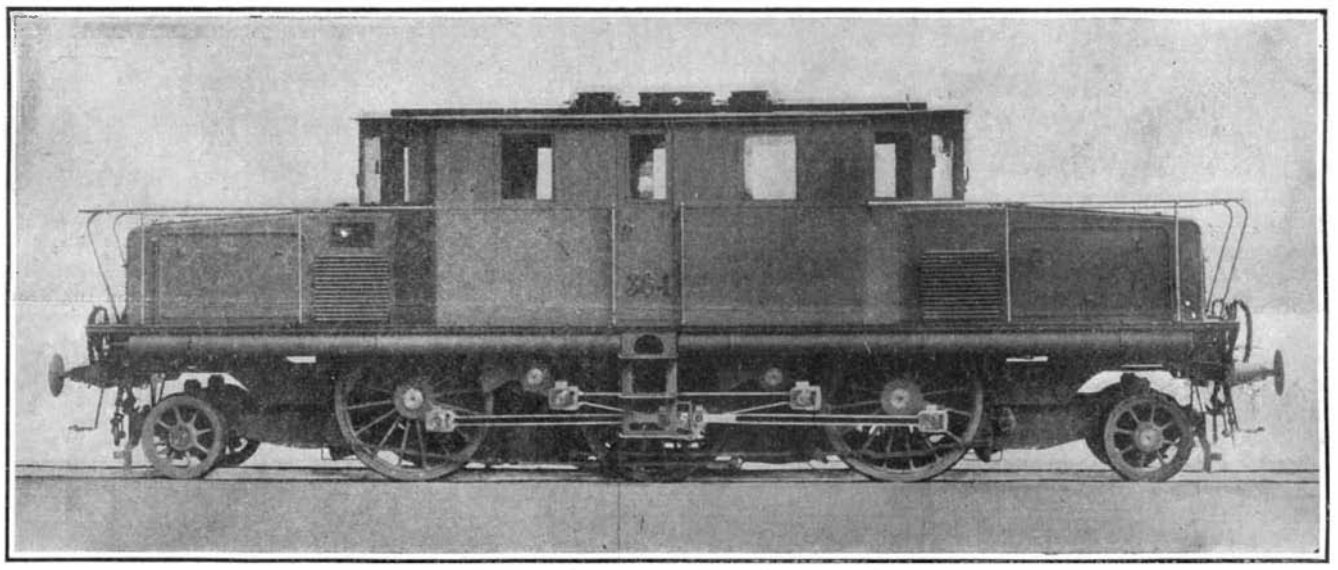
BY DR. ALFRED GRADENWITZ.

Although the first railway train has recently traversed the Simplon Tunnel, regular service on this important line leading from France and Switzerland to Italy will not be commenced before the end of May. Now this date is destined to be one of the most important in the annals of electric traction, this being the first instance in which electricity is used on one of the international European railway lines. It may be said that apart from the special advantages inherent in electric traction, and which were fully appreciated by the Swiss Railway, the ventilation difficulty in the case of steam operation was among the factors responsible for the choice of the electric service.

An interesting offer has been made by one of the most important Swiss electric companies, viz., to complete the whole of the electrical equipment of the tunnel by the date of opening, to place these equipments at the disposal of the Swiss Federal Railways, and thus to permit of a comparison between steam traction and electric service on a line especially adapted to illustrate the advantages of either system. In case, however, the electric service be not found at least as satisfactory as steam traction, Brown, Boveri & Co. will have to reduce the whole of the line to its primitive state, suitable for steam operation.

As on account of certain circumstances this offer could be made only a few months ago, the construction of a special railway stock was quite out of the question, and the constructors have to content themselves with using two three-phase locomotives of 900-1,000 horse-power each, which had been ordered a short time ago by the Italian State Railways. The three-phase system was accordingly adopted, which system has of late years given the most satisfactory results on numerous Swiss mountain railways.

The hydraulic power plants installed at either end



1,000-HORSE-POWER, 3-PHASE ELECTRIC LOCOMOTIVE FOR THE SIMPLON TUNNEL.

of the Simplon Tunnel, and which had so far served for operating the extensive machinery used in the construction of the tunnel, will after a few immaterial alterations and extensions be used in generating the current required for the electric service of the tunnel section. The current produced in each of these central stations, situated at Brigue and Iselle, respectively, has a tension of 3,300 volts at 15 cycles. As at first only the tunnel section proper connecting the two stations referred to is to be operated by electricity, this current is supplied directly to the trolley wire traversing the tunnel without any previous transformation or long-distance transmission. The trolley line in the tunnel is mounted on span wires fastened to hooks that are fitted in the masonry. The span wires are arranged at intervals of about 25 meters (82 feet) each, no shorter distances being required on account of the fairly uniform temperature in the tunnel, which eliminates the possibility of any considerable variations in the sag of the wire. The rails were bonded on the usual Brown, Boveri & Co. system. An electrically-operated turnout is provided at the center of the tunnel, but under normal conditions trains will not pass each other in the tunnel. Switches arranged at the ends of this turnout permit the trolley wire of the tunnel being divided into sections.

In carrying out the electric service, the steam locomotives will have to be uncoupled from the trains arriving from Lausanne at Brigue Station, and after substituting the electric locomotives the trains will be conveyed by electricity through the tunnel as far as Iselle, where the electric locomotives will again be replaced by steam engines. While, at first, only the tracks required in carrying out these operations are to be equipped with electricity, five tracks placed side by side will at some places have to be dealt with. Iron poles are used throughout in the station plants, the contact wires being mounted on span wires similar to those of the tunnel. At Iselle Station, where several tracks are to be spanned without any intermediary supports, the chain suspension principle is to be used, reducing the load of the poles to a minimum.

The locomotives constructed by Brown, Boveri & Co. (one of which is represented in the accompanying figure) have three coupled axles, driven by two motors through connecting rods without the employment of spur gearing such as are ordinarily used. The motors are designed for two speeds, viz., 34 and 68 kilometers (21.1 and 42.25 miles) respectively. The drawbar pull of the locomotive is 6 tons in the case of the low speed, and 3½ tons with the high speed. The total weight of the engine is 62 tons, and the adhesive weight 42 tons.

Gradients of up to 10 per cent occur only on some short sections of the line, which otherwise possesses a constant gradient of 2 per cent from Brigue to the middle of the tunnel, while the southern incline from the middle to Iselle shows a constant gradient of 7 per cent. Passenger trains will be limited to a weight of 365 tons, and freight trains to 564 tons, 20 minutes being allowed for the former in traversing the tunnel in the direction from Brigue to Iselle, and 30 minutes in the opposite direction, while freight trains will be allowed 40 minutes in either direction.

The preliminary installation work was commenced a short time ago, and while the trial runs are to be begun in the months of April and May, the electric service according to contracts will be opened on the first of June of this year.

One Person in Every Ten is Illiterate.

According to the census use of the term an illiterate is a person not under ten years of age who is unable to write either in English or in any other language. In most cases the illiterate is also unable to read.

At the census of 1900 the number of illiterates enumerated in the United States, exclusive of Alaska, Hawaii, and all other outlying territory, was 6,180,069. This was approximately one-tenth of the population at least ten years of age, the exact mathematical proportion being 106.6 illiterates to 1,000 population.

The fact that one-tenth of the population above nine years have failed to obtain even the little education that is implied in the ability to read and write seems to indicate a rather surprising degree of ignorance, reflecting upon the boasted efficiency of the common school systems. Therefore the patriotic American will naturally inquire whether this is not mainly due to the presence in our population of the foreign-born and the negro, and will be somewhat reassured to find that when the comparison is restricted to the native white population, the proportion of illiteracy is reduced to 46.4 per 1,000, or less than one in twenty. For the foreign-born white the proportion is 128.5 per 1,000 and for the negro 444.7. Moreover, international comparisons, restricted as far as possible to corresponding classes of the population, are on the whole favorable to this country, indicating that in most European countries illiteracy is much more prevalent than it is here, although the United States is still far behind Germany, Sweden and Norway, Denmark, and Switzerland. There is also ground for satisfaction and encouragement in the statistical evidence that illiteracy is steadily being reduced. In 1890 the number of illiterates per 1,000 was 133.4 for the total population, 62.3 for the native white population, 130.6 for the foreign-born white, and 567.6 for negroes, including Indians and Mongolians.

In Wales there are about 450 tin-plate mills of which 95 per cent were in operation at the close of November. In the United States there are about 340 regularly operative mills, which have been in work at one time or another within the past year, the leading interest having some 242 independent interests. There are about thirty other mills not in regular work. It can be assumed that an average of not less than 400 mills were operated in Wales during 1905, while an average of scarcely more than 275 mills were worked in the United States. With substantially the same total production, says the Iron Trade Review, it appears that the output per mill has been between a third and a half greater in the United States than in Wales.

THE WRIGHT AEROPLANE AND ITS PERFORMANCES.

According to the statement sent to the Aero Club of America recently by Messrs. Orville and Wilbur Wright (which statement is, by the way, the first authoritative one made by the brothers in their own country), they have already solved the problem of the century, mechanical flight, with their motor-driven, man-carrying aeroplane. During the past three years in which they have been experimenting with it, they have made 160 flights averaging a mile each, but not until the machine had been changed and improved many times was such a degree of success attained as to make it possible to cover long distances at high speed with safety. As a result, the final flight of 24 1-5 miles made on October 5 last was longer than the 105 flights of 1904 taken all together.

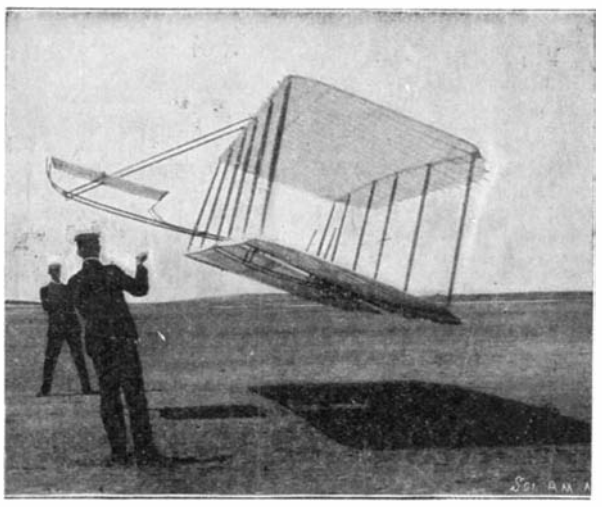
The success of the Wright brothers in being the first to make free flights over considerable distances with a motor-driven machine heavier than air comes as the result of an earnest effort, made during the past six years, to learn and master the principles of gliding flight. With the results of Maxim's experiments before them, they knew that a motor-driven aeroplane could be made practical *provided* it could be made stable. Therefore, after adopting the two-surface machine of Chanute (which consists of two superposed, rectangular, slightly-curved surfaces), they spent some three years making glides and attempting to improve the stability of their machine. Their ultimate, and very brilliant, success is due mainly to the recumbent position of the operator, and to the horizontal front rudder maintaining the proper fore-and-aft stability. There may also be other patentable improvements for maintaining the transverse stability, such as a method of twisting the planes slightly at either end.

The next step was to fit the machine with a suitable motor and propellers. This was done the latter part of 1903, and on December 17 the first flight was made with the motor-driven machine. This flight lasted only 59 seconds, but during it the aeroplane advanced a distance of 852 feet against a 20-mile-an-hour wind. The motor used on this occasion was a four-cylinder, air-cooled engine of 16 horse-power. In 1904 the Wrights continued their experiments with a motor-driven flyer; and on September 20 they accomplished for the first time the feat of describing a circle, while on November 9 and December 1 they made two flights of 3 miles each, which were the longest up to that time. In order to perfect the machine the brothers found that they had yet to overcome "several obscure and somewhat rare difficulties" which they had met with in their 1904 flights. Last year was therefore given up to this, and from June to October frequent flights were made above a swampy meadow 8 miles east of Dayton, Ohio, in which city the Wright brothers reside. Not until the middle of September were the experimenters able to correct the obscure troubles just mentioned. As soon, however, as these were overcome, the length of the flights continued to increase, as can be seen from the following table:

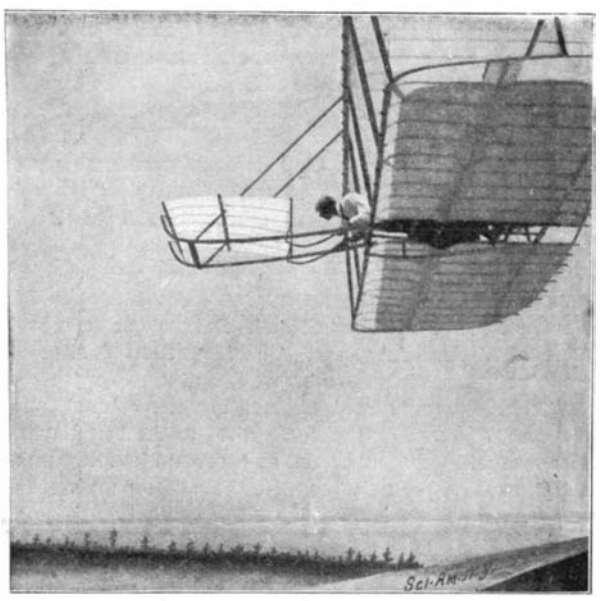
Date.	Distance. Miles.	Time. Min.	Sec.	Cause of Stopping.
Sept. 26	11⅛	18	09	Exhaustion of fuel.
Sept. 29	12	19	55	Exhaustion of fuel.
Sept. 30	....	17	15	Hot bearing.
Oct. 3	15¼	25	05	Hot bearing.
Oct. 4	20¾	33	17	Hot bearing.
Oct. 5	25 1-5	38	03	Exhaustion of fuel.

These flights were made in a rectangular or circular course about three-fourths of a mile in length. In making the last one mentioned in the table, the machine made 29.7 circuits above the field and attained an average speed of slightly more than 38 miles an hour. Taking account of the fact that on the straight parts of the course a considerably higher speed was maintained than at the turns, the machine very probably traveled 40 miles an hour or over when advancing in a straight line. The distances traveled during the various flights were measured by a Richard anemometer carried on the machine, and the records thus made agreed closely with the distances measured on the ground when the flights were in a straight line and the air was calm. It was impossible to effect an accurate comparison in this manner when the flights were made in a circle on account of the impossibility of tracing the course accurately on the ground.

The weight of the machine and operator as used last year was 925 pounds. The motor is said to have been a 24-horse-power, four-cylinder, air-cooled gasoline engine weighing complete about 250 pounds, or over 10 pounds to the horse-power. The lightest aeronautical motor so far constructed weighs but 2.2 pounds per horse-power; so that with the same size machine and a light-weight motor more than the weight of an extra passenger could be saved. No effort was made at lightness of construction, the object of the Wrights being to have a machine that is substantial and of practical utility, rather than one of great lifting power. How much the lifting power might be increased can be seen from the fact that Maxim found it possible to raise 133 pounds per horse-power, while the present experimenters have raised only 38, or (supposing that they actually used but 15 horse-power) 61 at a maximum. In view of the fact that the Wrights claim to have made every effort "to increase the scientific efficiency of the wings and screws in order that even heavily-built machines may be carried with a moderate expenditure of power," it does not seem that they have succeeded very well in obtaining the maximum lift possible per horse-power.



The Glider Flying as a Kite.



The Gliding Machine Soaring in Midair.

Owing to the fact that as soon as they had met with success the two brothers attempted to sell their machine to the French government for war purposes and that, having it unprotected as yet by patents, they did not wish to disclose anything about it, photographs or data of interest are not available for publication.

When the list of their flights given above was first announced last December in France, it was incredible to many people both there and here that so novel a device as a flying machine could be operated frequently for nearly six months in the vicinity of a large city without the fact becoming generally known. The Wrights refused to make a statement, and they gave the names of but a few persons who had seen them fly. With the communication recently sent by them to the Aero Club, however, they sent a list of names of seventeen men who were eye-witnesses of their experiments.

In order to dispel any lingering doubt regarding the flights, the reported accounts of which the leading German aeronautical journal, Illustrirte Aeronautische Mitteilungen, characterized as "ein amerikanischer 'bluff,'" a list of questions was sent to the seventeen witnesses. In all we received eleven replies.

To the first question, on what date or dates did you see the aeroplane fly, it was not possible to get exact information in every case. Ten of the witnesses agreed, however, that they had seen the aeroplane fly in the autumn of 1905, the majority in the month of October.

The second question, intended to bring out the length of the flights made on the various occasions, called forth answers which showed that the witnesses had seen the aeroplane fly for distances that varied from 15 to 28 miles, agreeing substantially with the Wright figures. The times given approximate fairly well with those of the Wright brothers.

In answer to the third question, Did the aeroplane fly in a circle or in a straight line? the replies indicated that the path covered was sometimes circular, sometimes elliptical, and sometimes rectangular.

The fourth question, Was the aeroplane attached in any way to any object, or was it absolutely free? called forth answers that left no doubt of its absolute freedom.

The fifth question, Did the aeroplane carry a man during the flight? was answered affirmatively.

In order to ascertain if possible the manner in which the machine was launched, the witnesses were asked in the sixth question whether or not the machine arose from the ground by its own power. From the replies received, it would seem that the aeroplane rested on a single rail 40 feet long, was pushed for a short distance by hand, and left the rail after having traveled 25 or 30 feet. The rail was level and raised about 6 inches from the ground.

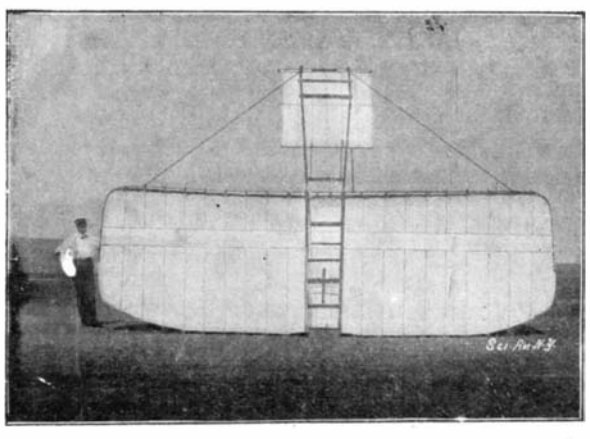
The seventh question was this: Was there a wind during the demonstration, or was the air calm? Inasmuch as the eleven witnesses who replied did not all see the same flight on the same day, it was not to be expected that the answers would agree. At one time the air was calm; at others there was a light or stiff wind.

As to the velocity of the wind, the subject of the eighth question, no very satisfactory information could be obtained. It seems, however, to have varied from 7 to 30 miles an hour.

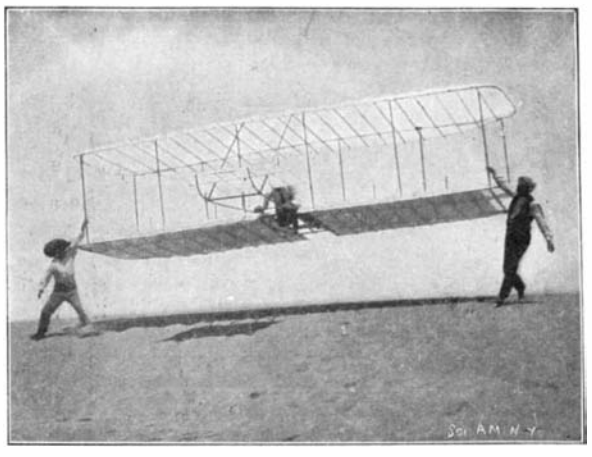
Inasmuch as the course of the machine was approximately circular on its various flights, most of the witnesses agreed, in reply to the ninth question, that the flight was made both with and against the wind.

The tenth question was this: If the flight was made in circles, and there was a wind blowing, was there any difference in elevation when the machine was flying with and against the wind? From the information gathered it would seem that there was some slight difference in elevation, although this did not affect the control of the machine in any way.

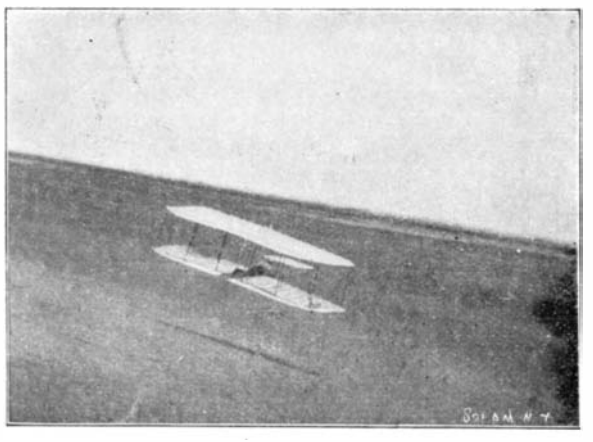
As to the speed of the machine when it alighted, the subject of the eleventh question, it was natural



A Bottom View of the Original Glider.



One of the Brothers Starting on a Long Glide.



Rear View of the Machine Gliding Down Hill.

The distinctive features of this machine are the horizontal rudder for maintaining the desired elevation and the horizontal position of the operator. When these photographs were taken, no vertical rudder had been fitted. Two of these are fitted to the motor-driven flyer directly behind the two propellers, which are placed symmetrically at the rear. A four-cylinder air-cooled motor of 16 to 24 horse-power, located behind the feet of the operator, drives the propellers by chains.

THE WRIGHT BROTHERS' AEROPLANE GLIDING MACHINE, TO WHICH, IN AN IMPROVED FORM, THEY HAVE APPLIED A GASOLINE MOTOR AND PROPELLERS, AND SUCCEEDED IN MAKING LONG FLIGHTS.

that the observers should not be in accord, since all had not seen the aeroplane glide at the same time. The craft seems, however, to have slackened in speed until it stopped. Some of the replies placed the speed it had when it touched the ground at the preposterous figures of 15, 20, and 30 miles an hour.

To the twelfth question, whether or not the aeroplane alighted on an even keel, rather vague replies were received. Two observers replied that the front was inclined upward, which was probably the case. Others thought that the aeroplane alighted on an even keel.

In addition to the replies given above from ten witnesses, seven of whom are residents of Dayton, we publish a letter in which all the questions are answered in a very satisfactory manner.

COPY.

Charles Webbert,
1121 West Third Street.
Dayton, Ohio, March 21, 1906.

Munn & Co., New York:

Dear Sirs: Your letter of March 19, with inquiries concerning the Wright brothers' flying machine, is received.

I witnessed one of their flights in the early part of October. I do not remember the exact date. The younger brother was aboard the machine, and remained in the air about a half hour. I heard that a longer flight was made the next day.

The machine traveled in large circles, apparently about a mile around. I did not keep track of the number of laps, but I think some one present remarked that he had counted twenty-four. The flyer was absolutely free from the time it left the rail upon which it started until it touched the ground in making its final landing.

The machine was assisted in starting on the rail, but after leaving the track, which was only a few inches from the ground, it gradually rose by its own power alone until it had attained a height above the tallest trees; after which it continued on a level course. The wind was light, and there was no noticeable difference in the height when traveling with and against the wind.

In landing, the machine approached the ground so gradually that I could not tell when it first touched. After sliding a short distance, it came to rest directly in front of the building in which it is housed. Mr. Wright shut off the power while still a few feet above the ground. He stated on alighting that the heating of a bearing in the machinery had made it unadvisable to continue the flight. The machine landed on a level without any noticeable jar.

Yours truly,

(Signed) Charles Webbert.

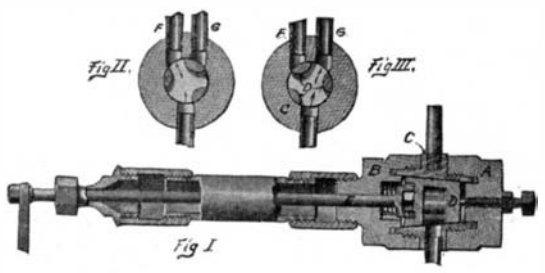
The letters which we have received all agree that the Wright aeroplane has flown and carried a man for a considerable distance, and that the machine rose from the ground mainly by its own power, and executed free flights in any direction in which the operator wished to guide it, both with and against the wind. According to these eye-witnesses, the elevation of the machine was under the control of the operator at all times, and he was able to cause it to alight either very slowly or at a considerable speed without damaging it in the least.

There is no doubt whatever that these able experimenters deserve the highest credit for having perfected the first flying machine of the heavier-than-air type which has ever flown successfully and at the same time carried a man. We congratulate them upon the accomplishment of this great feat, and we hope that they will soon see their way clear to give to the world, as did Maxim and Langley, some of the immense amount of valuable data which they have undoubtedly obtained while delving into the rapidly-developing science of aerial navigation.

Descriptions of the original gliding experiments of the Wright brothers have already been published by us in 1902; and in the current Supplement will be found the communication made recently by them to the Aero Club of America, in which they detail the gradual development of their machine, besides an article on the construction of their machine, which tells of the improvements they have effected.

AN EXHAUST VALVE FOR LOCOMOTIVES.

A patent has recently been granted to Mr. William H. Dyer, of 411 Jefferson Street, Ionia, Mich., on a simple exhaust valve for locomotives, adapted to furnish more or less draft in the firebox, without danger of creating back pressure in the engine cylinder. This end is attained by providing two outlet pipes, one extending to the top of the smokestack, so as to lead off the steam without producing a draft, and the other terminating within the stack, so as to produce a draft in the usual way. The valve is so arranged as to open one of these outlets while closing the other, and thus by varying the position of the valve the draft can be regulated at will. Our illustration shows a longitudinal section of the valve. The valve-head is made up of two members, *A* and *B*, which are threaded onto the valve casing *C*. Communicating with this casing at the bottom is the exhaust pipe, while from the top project the outlet pipes *F* and *G*. The casing *C* is formed with a taper bore adapted to receive the tapered plug *D*. This plug is formed of two end walls connected by three columns of the form, and in the position indicated in the cross sectional views, 2 and 3. These columns serve to close the pipes communicating with the valve casing. The valve is operated by a rod *E*, formed with a socketed head adapted to engage a squared offset on the plug. The coil spring in the member *B*, pressing against the socketed head, holds

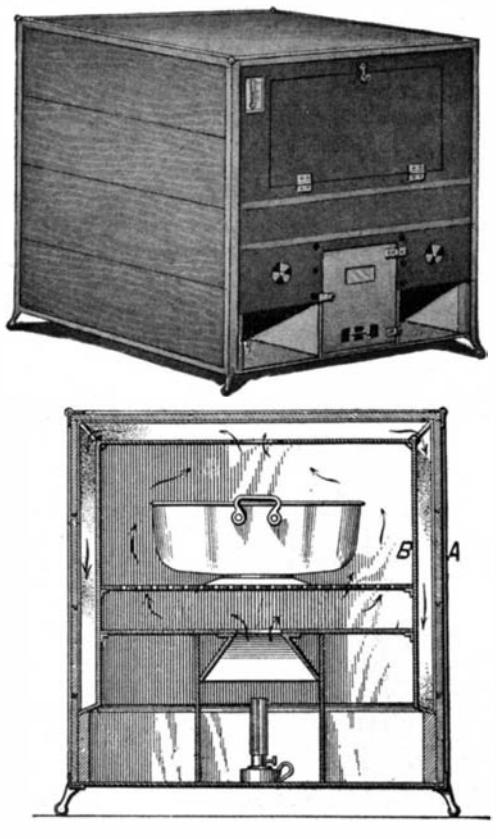


EXHAUST VALVE FOR LOCOMOTIVES.

the plug in engagement with a setscrew threaded in the member *A*. By means of this setscrew the plug may be adjusted to take up wear. The rod *E* passes through the outer wall of the smoke box, and is connected with a hand lever in the cab of the locomotive. Figs. 2 and 3 show two different positions of the plug. In Fig. 2 the short outlet pipe *F* is opened, admitting the entire exhaust into the smokestack, and thus producing the maximum draft, while in Fig. 3 the pipe *F* is closed, and the pipe *G* is opened, permitting the exhaust steam to pass out freely without causing any draft in the smokestack. Intermediate positions would provide all the variations of draft desired.

CABINET FOR BREAD MAKING.

A patent has recently been granted to Mr. John W. Knackstedt, of Gardena, North Dakota, on a novel piece of kitchen furniture. The invention consists of a cabinet adapted for use in bread making to raise the dough. A lamp is used for heating the cabinet, and the design is such as to use the heat to the best advantage, insuring more perfect and certain results than under ordinary conditions. In the accompanying engraving one of the views shows the cabinet in section, from which it will be observed that it comprises an outer casing *A* and an inner shell *B* with a continuous circulating chamber between them. The shell *B* is divided by two transverse walls into three chambers, the bottom one being reduced in width by two upright partitions. In this reduced chamber the lamp



CABINET FOR BREAD MAKING.

is placed, and the heat from this lamp passes through an opening at the top into the intermediate or distributing chamber. The upper chamber, which is adapted to receive the pan of dough, is separated from the heat-distributing chamber by a perforated wall, and is also provided with an opening at the top, communicating with the circulating chamber. In operation the heated air and the products of combustion of the lamp will pass from the distributing chamber around the pan of dough and thence into the circulating chamber and all around the shell *B*, finding exit finally through the vents at each side of the bottom chamber. The heat can be readily regulated and the temperature of the cabinet can be ascertained from a thermometer placed in the outside shell *A* back of a transparent pane. The open compartments at each side of the lamp chamber can be used for warming various articles.

Decisions in Patent Cases.

The Supreme Court has just settled an important question of procedure in cases arising under infringement of patents. The National Enameling and Stamping Company brought suit in the Federal Circuit Court in New York against the New England Enameling Company, alleging infringement of its patents for improvements in enameling metals. The court found that three of the claims made were invalid, four were valid but did not infringe, and as to five claims referred the matter to a master for the purpose of ascertaining the damages under them.

The New England Company appealed from the findings of infringement and the National from the seven claims which did not infringe, but the latter appeal was dismissed by the Court of Appeals on the ground that it could not be taken until a final decree was entered in the case. The National Company thereupon applied to the Supreme Court for a writ of mandamus to compel the reinstatement of its appeal by the Court of Appeals.

The Supreme Court, however, affirmed the action of the Court of Appeals dismissing it, holding that pending a final decree in the case the only appeal that could be allowed was from the interlocutory order of injunction. Although there were twelve claims in the patent action, says the court, there was but one suit, and it could not be broken up into several by the terms of the interlocutory order. The application for a writ of mandamus was therefore denied.

Similar action was taken in the case of the Automatic Switch Company, of Baltimore, against the Cutler-Hammer Manufacturing Company, which involved like procedure in a suit for infringement of automatic switches for electromotors.

The court also settled the question of breadth of claims under trademarks. One St. Louis manufacturer of wire rope registered as his trademark a strand of distinguishing color, and when another began making that kind of rope he brought suit for infringement. The claim as registered, the court said, was too broad. The colored strand might have gone in the same directions or around the other strands and no distinctive color was named. Lacking the necessary definiteness, the claim for infringement could not, therefore, be allowed, notwithstanding it had been registered by the Patent Office.

The Edison Works.

Those who are unfamiliar with the imposing buildings of the Edison Company, Valley Road, West Orange, can only fully appreciate the magnitude of the work carried on, by a personal inspection of the large plant. In lieu of this, the information furnished by the Journal, of Orange, N. J., will be of interest. It states that hundreds are employed in the phonograph works, and to properly inspect the complicated machinery which turns out the various parts of the machines would take several hours. The laboratory is another large feature of the establishment. The general office is a very active department, for it is here that many competent clerks are busily engaged in attending to the details necessary in the operation of the various branches.

Several new buildings are in course of erection, the principal one being that designed for the new storage battery. Although the neighborhood is typically suburban, within these vast works is all the activity of an immense metropolitan enterprise, and this fact is fully apparent when one once beholds the whirring machinery and the animated scenes in the various departments.

From present indications it would seem as if in a very few years there would be one vast accumulation of buildings, and a transformation of the immediate vicinity into a small manufacturing city. Lucrative employment is afforded to hundreds of young Americans, and merit is appreciated and rewarded. It is a very suggestive thought that it is owing to one man's genius that not only in West Orange, but in many other towns and cities, thousands of people find profitable employment, and that the various products are sent all over the world.

The gas industry in Great Britain, according to the Society of British Gas Industries, consists of 1,250 gas companies and local authorities, and supplies 4,400,000 consumers. The London companies—i. e., city and suburban within the 10 miles radius—included in the foregoing have 945,000 consumers.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

APPARATUS FOR LAYING ELECTRIC CONDUCTORS.—S. P. HATFIELD, New York, N. Y. The object of the invention is to provide an apparatus for laying and burying electric conductors on land and under water simply and inexpensively to prevent the conductors from being fouled by the anchors of marine vessels and to prevent the conductors from being easily detected or grappled and cut in time of war.

WIRELESS TELEPHONY.—A. F. COLLINS, New York, N. Y. The invention relates to the art of transmitting and receiving articulate speech between two or more stations without connecting-wires, but employing the earth or other medium as a means of propagation; and it relates more particularly to transmission of impulses into the earth or other medium by means of a direct or alternating current having a higher voltage and greater amperage than it has been found possible to employ heretofore and the reception of these impulses and their amplification and intensifications at the receiving-station.

Of Interest to Farmers.

LAWN-MOWER.—H. P. TERRY, Elizabeth, N. J. A supporting frame or yoke is provided for the structure, in which is supported a shaft for the main driving-wheels of the structure and combined with which is a rigid or stationary cutter or knife, together with a reciprocating cutter or knife, special means being employed between the aforesaid shaft and cutter or knife by which the latter is operated in the ordinary propulsion of the machine over a lawn or other surface.

BROOM-CORN-CUTTING MACHINE—C. R. HUCKLEBERRY, Paris, Ill. The design in this case is to provide a machine which may be drawn across a field by a team to rapidly cut the broom-corn, and the machine is so constructed and arranged as to even the varying lengths of the cut-off brush ends and trim off the superfluous butt-ends of the stalks of the longer brush ends, so as to bring them all to the same length before being delivered to the binder, which binds them in bundles.

RAKE.—W. W. IRWIN, Juneau, Alaska. The invention pertains to rakes, and particularly to those mounted upon wheels for operation by draft-animals. Its principal objects are to provide a strong and simple apparatus in which the teeth may be readily operated to release the accumulated material and in which said teeth may be raised bodily to clear the windrows and not drag down the piles when bunching.

Of General Interest.

SHOW DEVICE.—C. E. ISACKE, New York, N. Y. The device is intended to be constructed of paper or cardboard and to be used for advertising and display purposes, the object being to provide a cheap means of representing a box or package of merchandise to be advertised and for furnishing adjacent thereto or as a part thereof a card or surface on which the advertised matter may be produced.

APPARATUS FOR TREATING TEXTILE FABRICS.—O. OBERMAIER, Lambrecht, Germany. This invention refers to an apparatus for treating textile fabrics, as in dyeing, extraction of grease, bleaching, washing, etc., by means of circulating liquids. It produces not only a pressure, but also a powerful vacuum, in such a manner that during passage of liquid through the receptacle for effecting the treatment the vacuum acts by pulling on one side, while on the other side the pressure acts by pushing upon the liquids.

DRILL.—L. W. BANEY, F. E. BANEY, and J. OSTERHOLT, Platteville, Wis. With this improvement the turning of the drill to the right causes an outward movement of the debris, the stroke of the drill assisting this movement, each lug moving the debris outward to a sufficient extent that it may be engaged by the succeeding lug on the next stroke. In its broadest sense the invention comprises a drill-shank having a series of projecting lugs spirally arranged on the shank.

STAYING DEVICE FOR SLIDING DOORS.—F. DAHLUND, Esmond, N. D. The object of the improvement is to provide a device more especially designed for use on heavy sliding-doors, freight-car doors, and the like—and arranged to insure an easy sliding of the door, to prevent rubbing of the door on the wall or door-casing, and to prevent snow or ice from locking or holding the door against movement.

SHOT-FEED FOR DRILLS.—K. BROOKS, New York, N. Y. Automatically feeding shot or grinding material to drills and similar tools is accomplished by this simple and economic device, and it is particularly adapted for feeding shot to rotary drills employed in boring wells. It is automatic in its action and means for regulating the quantity of material delivered by the device, the feed being constant while the invention is in operation.

CORNET.—Z. A. MEREDITH, Tahlequah, Ind. Ter. This invention is an improvement in cornets and similar valved instruments, and has for an object to provide construction and arrangement of the tubing and air-passages whereby to avoid short bends or angles; also, to dispense with the usual second slide and introduce in lieu thereof a second bell through which the tone is emitted in all instances when the second valve is depressed.

Machines and Mechanical Devices.

ROTARY CUTTING DEVICE.—T. B. WILLIAMS, Orange, Mass. The invention has reference more especially to hand-operated devices—such, for instance, as ordinarily employed for dressing or resurfacing the seats of valves, faucets, and the like. The principal object is to provide an extensible bearing-support for a rotatable spindle, located exteriorly to the structure and capable of being lengthened or shortened in proportion to the different longitudinal adjustments of the spindle found necessary to be made under varying conditions of use of the structure

MOLDING-MACHINE.—C. REED, Portland, Ind. This inventor provides efficient and rapid adjustment of the machine's working parts; provides for pressing the molding materials from two opposite directions, so as to make the article solid and material completely fill corners and spaces around the cores; provides an entirely automatic arrangement, so that neither product nor any part of the machine will have to be lifted before molded article is completed; provides for delivery of article to a truck by which it can be taken away from the machine, and provides for making all kinds of articles movable by machinery and especially all kinds of building-blocks.

PIANO-ACTION.—F. B. LONG, Los Angeles, Cal. The object of the invention is to provide such new and useful improvements in piano-actions whereby the flanges for the hammers, dampers, or other parts of the action are not liable to become loose and rattle on playing the instrument or by reason of the climatic changes.

PULLING-MACHINE FOR STEAMBOATS, ETC.—F. W. HAYES and C. A. BILLINGS, Wendling, Cal. The invention is an attachment for steamboats and other water-craft for use as an aid or accessory for propelling them up swift streams or rapids, where the usual means of propulsion are insufficient. The invention is also adapted for use as the sole means of propulsion of boats or scows in canals or sluggish and shallow streams.

STAMP-AFFIXING DEVICE.—M. R. BURROWES, Sarnia, Canada. The object in this invention is to produce a device which will operate to moisten the parts and apply the stamp with great rapidity and in a certain sense automatically. It comprises a magazine in which stamps or labels are contained and beneath which the envelop or other article may be thrust. As the envelop passes beneath the stamp-magazine it is moistened automatically by the moistening device, and the mechanism is then operated to affix a stamp in required position.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 7994.—Wanted. mantled alcohol lamps for lighting

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 7995.—Warted, the name and address of the maker of "Gardner's Army and Navy Liniment."

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 7996.—Wanted, the name and address of the manufacturer of the glass tombstone or monument.

Manufacturers' Agent is open for a few good lines. Highest references. E. H. Peace, Vancouver, B. C.

Inquiry No. 7997.—Wanted, galvanized tanks to stand 125 pounds test, cold water, with manhole on side 11 x 7 inches; oval, 25 inches long, by 16 inches.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7998.—Wanted, electrical novelties run by dry batteries, such as electric railway locomotives, dynamos, motors and tops.

Fine Lithographed Letter Heads, Bill Heads, Envelopes and Checks, gives standing. Stilwell, 709 Pine St. St. Louis.

Inquiry No. 7999.—Wanted, makers of malleable iron thumb screws, with ball and cap ends.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 8000.—Wanted, apparatus for removing the overburden or covering when from 5 to 35 feet in thickness, overlaying a mineral deposit.

Metal Novelty Works Co., manufacturers of all kinds of light Metal Goods. Dies and Metal Stampings our Specialty. 43-47 S. Canal Street, Chicago.

Inquiry No. 8001.—Wanted, makers of balloons, kites, aerial toys, machines and aerial novelties of utility.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools, and wood fiber products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 8002.—Wanted, the makers of the Butchet motor.

Inquiry No. 8003.—Wanted, manufacturers of water stills and compressed air apparatus for aerating water.

Inquiry No. 8004.—Wanted, makers of automatic cam cutting machines for cutting large cams up to 20 inches in diameter.

Inquiry No. 8005.—Wanted, manufacturers of pillow ventilators.

The Development of House Painting.

The art of painting for decorative purposes is as old as civilization. In the fragments of Babylonian, Assyrian, and Egyptian literature that have come down to us there are frequent allusions to this form of decorative art, and the writings of Theophrastus, Pliny, Vitruvius, and others contain many interesting details regarding the nature of the colors so employed. In the ancient Egyptian monuments we still find the remnants of decorative coloring, especially on mummy cases which have been preserved from the air. There are remnants of flat color on the friezes of the Pantheon, etc.; buried statues from the antique world show traces of tinting, and the walls of the exhumed buildings at Pompeii are notably rich in wall paintings.

These colors have been examined by several chemists, notably Sir Humphry Davy, and the results lead to the conclusion that the pigments at the command of the ancient artists and artisans were chiefly natural products, such as gypsum, chalk, bitumen, ochers, siennas, iron oxides, carbon blacks, manganese oxide, lead oxides, arsenic and mercury sulphides, the copper carbonates and silicates, etc., with a few simple animal and vegetable dye colors.

It is remarkable that while both Pliny and Vitruvius describe the production and use of white lead, no trace of such use has been found in these analyses, though red lead (which occurs as a natural color) has been encountered frequently.

During the first sixteen or seventeen centuries of the Christian era also the use of paint was predominantly for decorative and artistic purposes, and the development of the technical side of paint and color making up to the eighteenth century was largely along these lines. Part of the stock in trade of the great painters, even down to the days of Sir Joshua Reynolds, Vandyck, Rubens, Velasquez, and the rest was their secret formulas and processes for preparing colors, oils, and varnishes.

The reason for the slow emergence of the idea that paint could be used for protective as well as for decorative purposes is not far to seek: Mediæval, Renaissance, and in England, even, Georgian architecture was the art of designing and construction in stone or its equivalent, bricks and mortar. In early times every man's house was literally his castle—his stronghold—and he whose position in life would not maintain a defensible stronghold was not a man but a villain, subject to the commands and dependent for protection upon his more fortunate lord.

The houses of the better classes were therefore stone fortresses; those of the lower classes, flimsy hovels, huts, or cabins. The castle needed no paint; the peasant's shelter was not worth it.

With the rise of the common people into the stature and privileges of human beings, however, wood became gradually a recognized building material, the preservation as well as the decoration of the wooden house became important, and the demand rapidly stimulated the development of paint, making it a commercial industry.

The earlier industrial paint makers naturally looked to the artists for their knowledge of paint; consequently we find the original house paints to be merely adaptations of artists' colors, gradually modified to permit of production on a commercial scale. Thus, the early process for producing white lead, for example—the old Dutch process—was merely an expansion of the artists' method of making "flake-white," a trench in the earth, charged with manure, being substituted for the hole in the artist's back yard. So, also, the older paint chemists—Scheele, Diesbach, Chaptal, Davy, Girardin, Vauquelin, and others—concerned themselves largely with investigation of the pigments then in use and the simplification of the methods and materials used in producing them. This fact can be verified by a glance at the pages of a comprehensive book published less than fifty years ago—the celebrated "Practical Treatise on the Manufacture of Colors for Painting" by the French authorities, Riffault, Vergnand, and Toussaint. Large space is given therein to the production of Prussian blue from animal offal, of lakes from vegetable dyes, of Turner's yellow, orpiment yellow, and uranium yellow, of quicksilver vermilion, of the arsenical and copper greens, etc. The chromate yellows and greens were then comparatively new pigments, as was French process zinc; much space is devoted to weird processes for making white lead, which have long passed out of memory; the coal-tar pigments and lakes were still far in the future; there was no American process zinc, no sublimed lead, no "zinc-lead," no "quick-process lead." And this book was the latest word on the subject by the leading European authorities at about the close of our civil war.

It is not overstating the facts to say that the introduction of ready-prepared paint making as a separate industry marked the first real impetus in the technical study of paints and the popularization of paint-using for protective as well as for decorative purposes. It began in this country about 1860, and has since developed so rapidly that a competent authority has estimated the consumption in 1900 at 60,000,000 gallons. A natural sequence of the American tendency to simplify, to systematize and to economize time and labor, it placed protective and decorative paints within the reach of all and made this country pre-eminently the paint-using country of the world.

There are now in this country something like two hundred and fifty paint-manufacturing concerns, properly so called, ranging in size from a small plant with an output of a few thousand gallons per year to single concerns operating a dozen or more plants, with their annual output running into the millions.

The demands of these factories have stimulated the production and diversification of pigments, until the list is almost endless; and the study of the paint chemists employed by them has thrown a flood of light upon the properties of paints undreamed of by the older color chemists. The result has been a rapid diversification and specialization of products, until at the present time we can obtain from any paint factory, ready for use, a paint for almost any purpose; exterior and interior tints and colors, floor paints, roof paints, barn paints, porch paints, carriage and wagon paints, enamel paints, car paints, locomotive paints, bridge paints, etc., in limitless variety.

Every manufacturer is constantly pushed by each of his competitors to produce something better and cheaper, and the result is that to-day's formula is displaced by to-morrow's discovery. In the pigments used there is much diversity and constant improvement; but after temporary experiments along other lines the entire trade has apparently come to an agreement that for the present, at least, there is no satisfactory substitute for pure linseed oil; consequently, he who examines these paints of the better grades will find, outside of the volatile thinners and the liquid "dryers" used, practically the entire liquid contents to be simply linseed oil.

Columns could be devoted to this unique vegetable oil; but it is enough to say that the United States annually consumes about 20,000,000 bushels of flaxseed in producing it, and that nothing has yet been discovered that so satisfactorily fulfills the requirements of house painting.

A great deal has been said and written against prepared paints—chiefly in the interests of painters, who cling to their ancient tradition and perquisites of hand mixing, or by those who cater to this trade; but the incontrovertible fact remains that the consumption of these products after a half century's experience is increasing steadily. This fact alone is sufficient answer to all objectors; nothing

that does not serve a useful purpose can permanently succeed. Frauds may flourish for a time, but their season is brief.

G. B. HECKEL.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9934) A. C. A. says: Please inform me through the Notes and Queries column, how the number of lines of force in a magnet are calculated. A. To calculate the number of lines of force in air through a given coil of wire, multiply the amperes by the number of turns of wire and this by 0.4 or by 1.257. This is fully explained in Sloane's Handy Book of Electricity, which we send for $3.50.

(9935) B. F. B. asks: I wish to procure the best method for drilling glass. A. For drilling glass make a solution of 1 ounce gum camphor, 1½ ounces spirits of turpentine, and 3 drachms of ether. Keep the end of the drilling tool wet with this fluid. The sharp corner of a freshly broken point of a file is one of the best drilling tools for this purpose.

(9936) L. E. B. asks: Does the space occupied by the spokes in a carriage appear to be filled with black dots when the moving carriage is seen through a lace curtain? I did not notice it when the carriage moved rather slowly, but when it was moving at a brisk rate. A. The phenomenon of the moving wheel viewed through a mesh of lace is due to the persistence of vision. Through the openings in the lace we see only a part of the spokes, and then this part disappears. We thus get a discontinuous view, broken more rapidly as the carriage moves more rapidly.

(9937) W. W. G. says: We would consider it a great favor if you will have the kindness to advise regarding driftwood fire powder. This is a powder which, as we understand it, is thrown on the fire and produces the same lights as driftwood does. Kindly advise if possible where same can be obtained. A. We do not know the composition of the driftwood powder. You can, however, make driftwood for yourself, which will give a color equal to any, by dissolving chloride of copper in water. Use a wooden pail for this, since it will corrode a metal pail. Place pieces of wood endwise in the solution, and allow them to soak till they are well saturated. Then dry them, and throw some pieces upon a bright fire. They will show the colors of the burning copper. A pound of copper chloride will make a great deal of driftwood.

(9938) F. S. J. asks: 1. Can you tell me what a wattless current is? How is it caused? A. The so-called "wattless current" is the component of the total current which is in quadrature with the energy current. It may be found explained in Sloane's "Electricians' Handy Book," which we send for $3.50. 2. Why do telephone companies always ground on a cold-water pipe? I know of a case where a lineman carried the ground wire past a hot-water pipe to a cold-water pipe. Why not ground on a gas or steam pipe? They are all connected to the ground. A. We cannot tell why telephone companies "always ground on a cold-water pipe," since we have just examined ours and find it grounded on the hot-water pipe. It is not proper to infer that a thing is always done in a certain way because we have never happened to notice it done in any other way. There is no reason for grounding on one pipe rather than the other. Gas pipes should not be used because of risk of setting fire, if a break occurs. 3. Is there any point on the American coast where there is no ebb or flow of tide? If so, where is it? A. We do not know any place where there is no tide. There are places so situated that a tide flowing one way meets a different phase of a tide from another direction and a very small change of tide results.

(9939) T. W. B. asks: As it is an accepted fact that an electric current can be caused to flow between the poles in a circuit connecting two metals such as bismuth and antimony when the point of juncture is heated, I should like to know what voltage and amperage can be produced or caused to flow if the ends of two rods ¼ inch in diameter, one of bismuth and the other of antimony, be joined together and heated in say 500 deg. of heat. I have the electric library published by Munn & Co., but do not seem to be able to get this information from same. In one place they state that a combination of this kind will generate "1 microvolt," but nowhere in the book can I find a statement as to what constitutes a microvolt. I have an apparatus in which a large amount of heat is radiated or wasted, and thought possibly that I would be able to generate a current of about six volts, twenty amperes. If this is possible will you kindly give me some information as to how to go about the work of assembling the apparatus? A. A microvolt is one millionth of a volt. Probably any dictionary would contain the word, or else the prefix "micro-," which is used as meaning a millionth part. Webster's Dictionary contains it. A treatise on electricity would assume that the reader had a dictionary and would not stop to define such a term. You cannot maintain a bismuth-antimony junction at 500 deg. F., since bismuth melts at 514 deg. F. Nor has anybody yet succeeded in making a thermo-electric generator which would produce six volts. One which gave about half this was on the market a few years ago, but cannot now be had. This one gave perhaps 1.5 amperes. We cannot encourage you to expect to invent a generator which would give 20 amperes.

(9940) H. E. E. asks: As a reader of your most valued publication, I am taking on myself the privilege of asking you where it would be possible to secure information regarding the latest or the best system of wireless telegraphy. I am seeking to build a system between two stations, about three hundred yards apart. Have been unable to secure anything satisfactory on the subject except from the columns of the AMERICAN, and that is all so condensed that it doesn't help much in putting in a system. I ask you, then, where I may secure a clear, concise treatise on the subject, which would enable an amateur to build his own system and at a nominal cost. A. Maver's "Wireless Telegraphy," price $2, is a very good book upon the subject, although Collins is somewhat more recent and is reliable. Its price is $3. We can send either or both upon your order. We have published in our SUPPLEMENT No. 1363, price ten cents, a very complete description of a set of instruments which will transmit much farther than you propose to send messages. We would advise you to get this, if you have not already done so, and to follow the instructions given therein. A large number of people have built sets from these instructions. We would say, however, that no one can build the instruments at a nominal cost. The coherer, the relay, and the induction coil must be well made or else they are worthless.

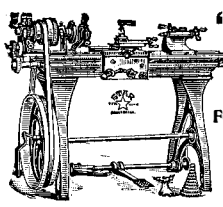
INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending March 27, 1906.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents]

Account cabinet, B. C. Maxwell	816,025
Adding machine, Kodama & Gancher	816,342
Adjustable seat and desk, J. T. Brent, Jr.	816,292
Air purifier, H. Platz	816,371
Amalgamator, W. H. Morgan	816,243
Amusement apparatus, C. C. Dean	816,220
Amusement apparatus, O. M. Connelly	816,435
Animal chase, Elder & Turner	816,081
Animal trap, J. D. Kittrell	816,102
Animal trap, C. C. Sphung	816,394
Animal trap, J. J. Swint	816,398
Armor plate, making, J. Strauss	815,985
Asphalt screen and storage bin, F. A. Hetherington	816,229
Automatic carrier, S. H. Libby	816,484
Bale tie machine, G. A. Rumbel	816,381
Ballast trimmer, J. H. Drinkwater	816,223
Battery, E. W. Schneider	816,384
Bearing for electric meters, frictionless, T. J. Johnston	816,330
Bed, invalid, J. W. Summers	816,048
Bed, sofa, Strand & Haugen	816,134
Bias cutting implement, N. B. Burt	816,529
Bicycle attachment, G. W. Pulliam	816,122
Binder frame and leaf therefor, loose leaf, H. J. Moore	816,493, 816,494
Binder, loose leaf, J. B. Barlow	816,421
Blackboard trestle with adjustable map displayer and roll support, M. Nacken	815,974
Bleaching and sterilizing apparatus, S. Leetham	816,482
Blind fastener, Durn & Anderson	816,224
Blind slat clipper, S. C. Smith	816,263
Block. See Pulley block.	
Block molding machine, G. Wilhelm	816,408
Bobbin holder, A. E. Rhoades	816,502
Boiler water feeding device, steam, J. T. Innes	816,471
Bolt threading machine, J. H. Haskins	816,322
Book support, F. E. Ruger	816,380
Book support, E. Smering	816,507
Boot and shoe tree, S. French	816,453
Boot or shoe polishing machine, Biladeau & Chapdelaine, reissue	12,466
Bottle, W. W. McLaren	816,358
Bottle, J. C. Anderson	816,419
Bottle cap and brush, J. Lane	816,481
Bottle clip, J. J. McGarry	816,244
Bottle, corkless non-refillable, R. I. Maxwell	816,170
Bottle holder and opener, combined, Mulvaney & Keller	815,971
Bottle holder, nursing, E. S. Lewis	816,105
Bottle, non-refillable, Perry & Pierpoint	816,121
Bottle, siphon, J. G. Henrich	816,091
Bottle stopper, H. K. Gilbert	815,954
Bottle stopper, H. E. Payne	816,120
Bottles, etc., stopper for, J. P. Crane	815,940
Bracket, A. R. Ferguson	815,947
Brake hanger, G. M. Brill	816,293
Brake shoe, J. F. Powers	816,373
Brick making machine, C. W. Pratt	816,374
Bucket and trap, combined minnow, E. Petmecky	816,251
Bucket or conveyer, W. F. Jones	816,332
Building construction, O. Price, reissue	12,467
Bur, loop unifying and cast-off, E. Tompkins	816,403
Burglar alarm, J. A. Dillen	816,005
Bushings, machine for forming hollow split, P. Kohlbrenner	816,237
Button, R. H. A. D'Ailly	816,416
Button making machines, gripping device or carrier for, J. Hornby	816,094
Calculating machine, H. Hanson	816,318
Calculating machine and typewriter attachment, H. Hanson	816,319
Can opener, W. T. Seerup	816,256
Can top, powder, J. H. Goss	816,313
Cans, handled head for sheet metal, C. Sherman	815,983
Cans or boxes, hinged cover for square or rectangular sheet metal, B. H. Larkin	815,962
Candy machine, W. J. Morrison	816,114
Car body bolster, railway, C. S. Shallenberger, reissue	12,468
Car construction, R. L. Ettenger	815,946
Car coupling, W. Kelso	816,165
Car coupling, Keller & Bowers	816,336
Car, dump, S. Otis	816,498
Car, hopper bottom, T. R. Brown	816,070
Car, sleeping, H. M. Pflager	816,037
Car wheel, H. C. Odenkirk	816,363
Car window, H. F. Dietz	816,539
Carbureter, G. W. Kellogg	816,477
Carbureting apparatus, M. Steel	816,267
Cards, playing, J. H. Noonan	816,119
Carpet cleaning and disinfecting machine, E. A. Thomas	815,987
Carrier, O. Johnson	816,473
Carton making machine attachment, R. Sunderman	816,273
Cash register, Bockhoff & von Pein	816,066
Caster, G. E. Neuberth	816,177
Caster, F. F. Bischoff	816,211
Caster, C. Stengel	816,269
Castings, metal mold for making brass, F. Haggenjos	816,315
Cement and making the same, slag, J. A. Shinn	816,389
Cement block machine, C. F. Davis	816,438
Cement block molding machine, F. F. Martin	816,488
Centrifugal machine, W. E. Andree	816,058
Chain, H. A. House	816,096
Chain link, F. V. Hetzel	816,325
Chain securing device, logging, F. Peikard	816,249
Chair, A. E. Beall	816,209
Chair lounge, J. Flindall	816,084
Channeling machine, L. F. & A. J. Uthe	816,050
Cheese cutter, J. Halliday	816,462
Chime ringing apparatus, A. E. Adriance	816,525
Churn, F. E. Kronquest	816,166
Churn motor, J. M. McBride	816,353
Cider press, B. Witmer	816,414
Cigar moistener, J. S. Winget	816,413
Cigarette making device, A. E. Buckingham	816,150
Circuit controlling apparatus, R. D. Mershon	816,112
Circuits, making and breaking high potential, E. M. Hewlett	816,468
Circuits, transfer switch for testing, Whitaker & Wood	815,993
Clamp. See Woodworking clamp.	
Clamping jaws, means for preventing differential movement of, F. Van Amber	815,988
Clod crusher, J. W. Dalrymple	816,153
Coal and other granular material, apparatus for handling, A. Smith	816,391
Cock, self-closing basin, J. A. Johnston	816,329
Coffee and cereal roaster, K. H. Rommel	816,379
Collapsible table, C. R. Sheldon	816,258
Collar pad, horse, W. F. Sachse	816,127
Column cap and base, combined, J. Lally	816,480
Composite construction, tension member for, J. Kahn	816,334
Concrete, apparatus for lining tunnels with, J. W. Reno	816,040
Concrete building blocks or veneer blocks, machine for manufacturing solid, R. Edmondson	816,542
Condenser, L. Schutte	816,043
Conveying apparatus, C. H. Locher	815,963
Conveying apparatus, pneumatic, A. C. Lynch	815,965
Cooler, cream ripener, and pasteurizer, combined, D. W. Payne	816,181
Coop, folding chicken, C. J. Laidig	816,103
Copying press, letter, G. H. Taylor	816,399
Cord fastening device, D. A. Wedmore	816,140
Coupling, H. C. Clay	816,218
Coupling device, A. E. Scouten	816,129
Crate, folding, F. J. Hipp	816,164
Cream separator, centrifugal, F. A. West	816,199
Culinary vessel, H. McConnell	816,356
Cultivator, T. Mulally	816,351
Cultivator, F. E. Schaal	816,382
Cultivator, road machine, and farm wagon, disk land, A. L. Foote	816,085
Current generator, alternating, C. P. Steinmetz	816,395
Curtain and counterbalance for book and other cases, A. McKenzie	816,496
Curtain holder, G. W. Barnett	816,289
Curtain pole, J. N. Mills	816,490
Decorticating machine, M. Castellon	816,296
Dental tool holder or clutch, B. S. Brown	816,069
Desk, school, W. H. Stockman	816,272
Diaper, Peters & Mason	816,036
Disappearing seat, S. M. Curwen	816,537
Display apparatus, illuminated, F. M. D'Arsi	816,154
Display can or box, sheet metal, E. M. Hallbauer	815,957
Display can, sheet metal, Rudolphi & Geiger	815,981
Display can, floral, L. Wittbold	816,053
Door, F. K. & A. M. Eastman	816,441
Door controller, sliding, A. M. Easton	816,551
Door, grain, E. A. Hill	816,230
Door locking mechanism, B. F. Tripp	816,049
Door securer, E. M. Hoagland	816,327
Dredging apparatus, J. Hamilton	816,161
Drill shanks, equalizing weight feed for, K. Brooks	816,295
Drilling machinery feeding mechanism, C. F. Preslar	816,500
Driving mechanism, variable speed, W. L. Schellenbach	816,128
Dropper, G. Spencer	815,984
Drum screen, revolving, Brew & Suiter	816,426
Dry closet, T. Macfarlane	815,969
Duplicating machine, H. C. Gammeter	816,311
Dust collector and like apparatus, A. C. Lynch	815,967
Dust collector and separator, A. C. Lynch	815,966
Dynamic trap or drain valve, J. F. McElroy	816,245
Easel, J. B. Thompson	816,274
Edge trimmer, J. A. Gates	816,459
Egg boiler, time, H. H. Chesbrough	816,072
Electric cable, H. W. Buck	816,428
Electric heater, Morse & Frazer	816,172
Electric light socket and key, O. C. Cover	816,436
Electric light wires, rosette for, J. H. Parker	816,033
Electric machine, dynamo, C. P. Steinmetz	816,511
Electric meter, W. H. Pratt	816,375
Electric pressure indicator, J. E. Wertz	816,407
Electric road crossings, safety system for, A. H. Johnson	816,014
Electric switch, M. H. Johnson	816,100
Electric switch, Everest & Barker	816,444
Electrical device and circuit, W. H. Lane	815,961
Electrical generator, W. Stanley	816,192
Electrical regulation system, W. L. R. Emmet	816,442
Electrical switch, J. F. McElroy	816,028
Elevator. See Grain elevator.	
Elevator safety device, S. Kacso	816,333
Engine, W. Heckert	816,464
Engine and car coupling, railway, E. Posson	816,038
Engines, current controller for igniting devices for hydrocarbon, F. O. Farwell	816,083
Engines, drill bit rotating mechanism for rock drilling, J. G. Leyner	816,021
Engraving machine, W. S. Eaton	816,307
Excavator shovel, T. Alexander	816,057
Explosive engine, T. J. Lutz, Jr	816,109
Eyeglass cleaner, H. C. Fosberg	816,227
Fabrics, adjustable guiding mechanism for skewing bridge threaded, E. T. & E. H. Marble	815,970
Fastening device, headed, E. T. House	816,095
Faucet, W. A. Speakman	816,133
Faucet, F. A. Dunham	816,440
Faucet and filter, combined, A. P. Whalen	816,517
Feeding device, D. Collins	816,219
Fence making machine, wire, J. M. Denning	816,538
Fencing tie, wire, F. H. Benedict	816,210



"Star" Foot and Power Screw Cutting Automatic Cross Feed Lathes

FOR FINE, ACCURATE WORK

Send for Catalogue B.

SENECA FALLS MFG. CO.
695 Water Street,
Seneca Falls, N. Y., U. S. A.

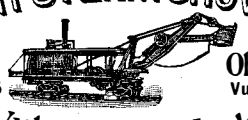
Engine and Foot Lathes

MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. BEST MATERIALS. BEST WORKMANSHIP. CATALOGUE FREE

SEBASTIAN LATHE CO., 120 Culvert St., Cincinnati, O.

Foot and Power and Turret Lathes, Planers, Shapers, and Drill Presses.
SHEPARD LATHE CO., 133 W. 2d St. Cincinnati, O.

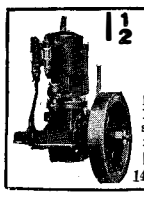
GIANT STEAM SHOVELS



Toledo 125 Ohio, U.S.A. Vulcan Place

The Vulcan Iron Works Co.

1½ H. P. MARINE ENGINE



$33.50 Engine Only

Engine and Engine Fittings $37.50

For your Row Boat, Sail Boat or Launch

No cranks to start—No cams, valves, gears, springs or sprockets. All working parts in full view. We build all sizes Boat Engines.

DETROIT ENGINE WORKS,
1425 JEFFERSON AVE. DETROIT, MICH.

A. W. Faber.

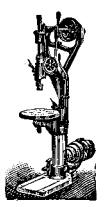
Manufactory Established 1761.

Lead-Colored & Slate Pencils. Rubber Bands, Erasers, Inks, Penholders, Rulers, Water Colors, Improved Calculating Rules.

Send for descriptive Circular S.

44-60 East 23d Street, New York, N. Y.

Grand Prize, Highest Award, St. Louis, 1904.



ORIGINAL BARNES

Positive Feed Upright Drills

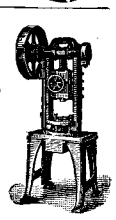
10 to 50-inch Swing

Send for Drill Catalogue.

W. F. & JNO. BARNES CO.
(*Established* 1872)
1999 Ruby St., Rockford, Ill.

TRADE W.F. & J.B. MARK

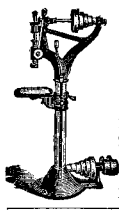
Presses for Sub-Press Work.



Five sizes. Sub-Presses and Tools to order.

Send for Catalogue.

BLAKE & JOHNSON,
P. O. Box 1054, WATERBURY, CONN



THE B. F. BARNES 14-INCH DRILL

is adapted for work from 1-16 inch to ¾ inch. A strong, substantial, well built drill. Plain lever or power feed as desired. We build a full line of Drills. All sizes furnished in Gangs. Also have 9-inch, and 11-inch Screw Cutting Lathes, and a 24x2-inch Wet Tool Grinder. Catalog S on request.

B. F. BARNES COMPANY, Rockford, Ill.
European Branch, 149 Queen Victoria St., London, E.C.

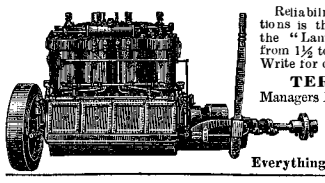
Mustard & Company

GENERAL IMPORTERS AND COMMISSION AGENTS

Plumbing Supplies. Safes and Scales. The largest Hardware Machinery and Tool House in China

9a NANKING ROAD - SHANGHAI CHINA

RELIABLE MARINE ENGINES



Reliability under all conditions is the characteristic of the "Lamb" Engines. Sizes from 1½ to 100 H. P. in stock. Write for catalogue.

TERRY & CO.
Managers Eastern and Foreign Branch
92 Chambers St., New York

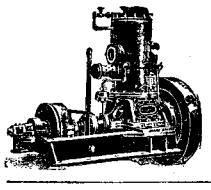
Everything for Boat & Engine

WELL DRILLING Machines

Over 70 sizes and styles, for drilling either deep or shallow wells in any kind of soil or rock. Mounted on wheels or on sills. With engines or horse powers. Strong, simple and durable. Any mechanic can operate them easily. Send for catalog.

WILLIAMS BROS., Ithaca, N. Y.

KEROSENE OIL ENGINES



Marine Stationary Portable.

NO DANGER, Maximum Power, Lightest Weight, Simple, Reliable, Economical. No Batteries, Self ignition by Compression. Fully Guaranteed. Write for Catalogue P M. ☞No charge for packing.

International Oil Engine Co.
253 Broadway, N. Y., U. S. A.

Watch Tacoma Grow!

POPULATION { 1900, 37,714. 1906, 85,000.

Leading manufacturing city of Pacific Northwest. Best steamship and railway terminals on Pacific Coast. Six additional transcontinental railroads entering Tacoma. Send ten cents in postage for illustrated literature to SECRETARY, CHAMBER OF COMMERCE AND BOARD OF TRADE, Tacoma, Wash.

TO THE LAND OF THE MID-NIGHT SUN

From

NEW YORK to ICELAND SPITZBERGEN and NORWAY

Leaving June 23, 1906

by the twin-screw express S. S. "Oceana," 8,000 tons, specially equipped for pleasure cruising. Superb accommodations. Rates including all side-trip expenses if desired.

12 Other Similar Cruises

by well-known steamers Blücher, Prinzessin Victoria Luise, Meteor, during

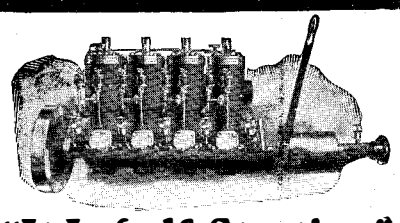
June, July and August

For programmes, rates, etc., apply

HAMBURG-AMERICAN LINE
Offices: 35-37 Broadway, N. Y.

PHILADELPHIA . . 1229 Walnut St.
CHICAGO . . 159 Randolph St.
SAN FRANCISCO . . 401 California St.
BOSTON . . . . . 90 State St.
ST. LOUIS . . . . . 901 Olive St.

SMALLEY
MARINE GAS ENGINES



"It Is Self Starting"

INDIAN RIVER, MICH., October 14, 1905.

SMALLEY MOTOR CO., Bay City, Mich.

Gentlemen—You can refer anyone to me in regard to the Smalley motor; my motor runs perfectly. There is one thing about your motor that you do not mention—IT IS SELF STARTING. My motor starts just as sure as steam if it has not stood over ten hours; if it has I only have to turn the fly wheel back one-quarter turn in the morning, but that is all for the day. Your rotary timer starts the engine every time. I don't think you mention this in your catalogue, but for a perfect motor it can't be beat. Yours truly, CAPT. WM. F. DAGWELL.

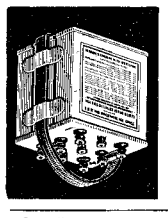
BAY CITY, MICH., June 10, 1905.

SMALLEY MOTOR CO., Bay City, Mich.

Gentlemen—After using the 12 H. P. engine I am pleased to report to you that the engine has proved far beyond my expectations. In all my use of the engine I have never known it to miss an explosion. I have kept actual count of twenty-seven times I have started engine after having made stops at various points along the river and in twenty-six of these twenty-seven times I have never used either starting lever or turned a wheel, simply starting engine by means of the commutator. IT IS SELF-STARTING. Yours very truly, CHAS. CORYELL.

Send 10 cents in stamps for complete illustrated catalogue. Address Dept. W.

SMALLEY MOTOR CO., LTD., Bay City, Mich., U. S. A.
Member of the National Ass'n of Engine and Boat Mnfrs.



HANG IT

upside down if you like, and it won't spill a drop. Of course it's the "GEECEE" Dry Storage Battery, which during the recent New York Show was used in all the demonstration cars of the following firms: Olds Motor Works, Berkshire Automobile, York Automobile, etc.

An ideal battery for all kinds of ignition work, small incandescent lights, dental engines, cauteries, wireless telegraph, small motors, etc. Write for '06 Catalog and trade prices.

Royal Battery Co., 143 Chambers St., N. Y.

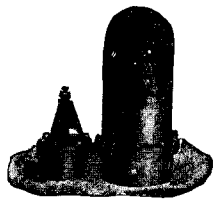
ELECTRO MOTOR. SIMPLE, HOW TO make.—By G. M. Hopkins. Description of a small electric motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641. Price 10 cents. To be had at this office and from all newsdealers.

Will make for you

$100 A DAY

Spin sugar into cotton candy any color or flavor. Agents wanted.

BARTELL MACHINE CO.
53 W. 8th St., New York, U.S.A.



Automatic Water Supply

Most economical, reliable and efficient. If you have running water the Niagara engines will elevate 35 feet for each foot fall obtainable from spring, brook, or river, delivered to any distance. Write for catalogue.

Niagara Hydraulic Engine Co
140 Nassau St., N. Y.

Fertilizer distributer, R. J. Taylor	816,400
Fibrous material and dyeing same, blue, V. Fussganger	816,457
Fifth wheel, vehicle, E. Lewis	816,168
Filaments and films from viscose, manufacture of, C. N. Waite	816,404
Filaments substances liquefiable by heat, converting into, T. J. Zoeller	816,056
Filter, W. B. Klein	816,479
Fire alarm box, S. J. Heinrich	816,465
Fire escape, K. Pugh	816,183
Fire escape, S. Z. Moore	816,495
Fire extinguisher, H. T. Murphy	816,352
Fire pot, R. M. Hinman	815,959
Firearm, tubular magazine, T. C. Johnson	816,015
Fireproof and waterproof composition, E. Covington	816,532
Fireproof fixture, E. F. Fitzpatrick	816,309
Fireproof window, W. H. Hiller	816,242
Fish hook, C. A. Shaw	816,130
Fish preservation, W. Lamb	816,343
Flanging machine, cap, J. Brenzinger	816,001
Fleece carrier, T. E. Ainley	816,417
Flower stand or support, W. H. Crawford	816,077
Flue stopper, Bacon & Aab	816,060
Fly trap, J. B. F. Pierce	816,499
Fork, J. W. Currier	816,536
Fruit gatherer, G. H. Roberts	816,186
Furnace, J. J. O'Shea	816,248
Furnace, R. S. Thompson	816,275
Furnace charging apparatus, blast, J. W. Dougherty	816,222
Fuse box, E. M. Hewlett	816,469
Fuse, electric, B. S. Luther	815,964
Fuse, expulsion, C. E. Eveleth	816,443
Fuse, percussion, J. W. Harriman	815,958
Fuse plug, A., Sr., & A. Weber, Jr	816,406
Game board, S. E. Kuhn	815,960
Garbage receptacle, Gagnon & Paquette	816,087
Garment clasp, M. B. Gardner	816,228
Garment, one-piece blouse, J. B. Pearson	816,367
Gas burner, inverted incandescent, J. Bridger	816,427
Gas burner, safety, E. & R. Smejkal	816,620
Gas calorimeter, C. E. Sargent	816,042
Gas engine, I. S. Barnett	816,062
Gas engine, W. Heckert	816,549
Gas engine, tandem, L. F. Burger	816,215
Gas filter, G. A. Stebbins	816,266
Gas furnace, R. S. Thompson	816,276
Gas generator, J. Radcliffe	816,123
Gas, making and burning fuel, W. T. Griffin	816,314
Gas mixer, M. Scott	816,045
Gas tank, P. C. Avery	816,059
Gases or vapors and the production of high vacuums, absorbing, J. Dewar	815,942
Gate, F. W. Schaefer	816,188
Gear, change speed, J. Thannheimer	816,401
Gearing device, automatic, J. Shoecraft	816,259
Generator. See Current generator.	
Grain crushing apparatus, A. & A. Simon	816,390
Grain elevator and wagon dump, R. J. Jones	816,017
Graphite separator, J. H. Davis	816,303
Grinding disk, clearance space, G. Gorton	816,461
Grinding machine, L. W. Holub	816,550
Grist mill, portable, J. S. Lord	816,108
Gun stock, W. F. Cole	816,074
Hair clipper, O. W. Johnson	816,235
Hair pin rubbing and polishing machine, W. H. Thompson	816,137
Hammer, power, C. W. Blackstone	816,291
Hammock supporting frame, C. Knoernschild	816,340
Harrow, riding, P. Fleming	816,449
Hat or garment holder, B. Kreuzberger	816,238
Hay rake and stacker, O. B. Mann	816,346
Headlight, railway car and locomotive, A. Walter	816,139
Heating system, house, J. A. Wynkoop	816,523
Hinge, gate, S. H. Berrey	816,527
Hoe, W. A. Nyswonger	816,362
Hoe and rake, combined, W. L. Harris	816,320
Hoe, horse, F. W. Anderson	816,418
Hog hoist, O. P. Hurford	816,233
Hoist, E. Y. Moore	816,349
Hoisting apparatus, J. Campbell	816,071
Hoisting apparatus, W. B. Potter	816,372
Hook, M. M. Baird	816,206
Hose coupling, W. B. Ward	815,990
Hose coupling, Williamson & O'Brien	815,995
Hose coupling, J. F. McElroy	816,029
Hose coupling, E. E. Gold	816,312
Hot air furnace, A. Boyce	816,528
Hot air heater, S. W. Wilt	816,412
Hot water bag stopper, G. H. F. Schrader	816,503
Hotbed, J. A. Hellstrom	816,323
Husking peg, J. H. Akin	816,286
Hydrocarbon burner, J. F. Higgins	816,470
Ice cream freezer, F. A. Holmes	816,092
Ice shaving machine, G. W. Van Sant	816,281
Ignition mechanism, sparking, J. F. Johnson	816,472
Incubator, J. E. Chambers	816,003
Index, book, C. D. Threlkeld	816,138
Index rod, card, D. E. Hunter	816,097
Insulation and other purposes, refractory material for electric, D. M. Steward	816,270
Insulators and other uses, producing new refractory material for the manufacture of, D. M. Steward	816,271
Iron from the ore, making, R. H. Aiken	816,142
Journal box, J. Charky	816,432
Keyhole bit and saw, combination, E. R. Townley	816,277
Knob for locks and latches, B. Phelps	815,977
Lamp burner, E. D. Holley	815,232
Lamp holder, T. Sharp	816,504
Lamp holder, electric incandescent, Leonard & Jones	816,483
Lamp, signal, F. D. Spear	816,509
Lamps, device for supporting cables of electric, J. F. Burns	816,429
Leaf turner, M. J. Brennan	816,068
Leather, dyeing, R. Rieder	816,378
Ledger, W. Wylie	816,521
Letter box, G. L. Pask	816,366
Lifting jack and shaft support, combined, R. G. Morgan	816,113
Line reel, G. W. Williams	816,410
Link, leader, W. E. Soper	816,264
Liquid containing vessels, stand for, O. Hammarlund	816,317
Liquid treating apparatus, H. O. Fisher	816,448
Lock, N. W. Webb	816,405
Lock, M. Mohr	816,492
Lock and latch mechanism, B. Phelps	815,976
Lock indicator, W. I. Fox	816,310
Locomotive sand box, W. H. Clowry	816,073
Locomotive snow and ice flanger, F. C. Arey	816,526
Log chock, J. E. Knight	816,339
Loom brake mechanism, R. Crompston	816,534
Loom filling stop-motion, N. Foerster, et al	815,952
Loom shed forming mechanism, R. Crompton	816,535
Loom, weft replenishing, N. Foerster, et al.	815,951
Loom weft replenishing mechanism, F. O'Donnell	816,364
Looms, automatic filling replenishing mechanism for, N. Foerster	815,948
Lubricating journal bearings, device for, F. J. Randall	816,253
Mail box, W. A. Wheeler	816,200
Manifolding apparatus, J. Bengough, et al.	816,063
Massage instrument, W. G. Shelton	816,506
Massage treatment, vibrator for, W. Olson	816,365
Masticator, H. Laurent	816,104
Matching machine, gang, G. E. Priest	816,039
Mechanical motor, C. Dackiewicz	816,437
Mechanical movement, F. H. Richards	815,979
Mechanical movement, O. L. Field	816,546
Medicines, making, R. Gross	816,547
Melting device, centrifugal, T. J. Zoeller	816,055
Metal cutting machine, F. Wesel	816,198
Meter. See Electric meter.	
Meters, coin attachment for prepayment, Doyle & Averill	815,945
Miter cutter, W. H. Trogden	816,279
Moisture proof structure, H. Feder	816,226
Motor governor, pneumatic, J. W. Macy	816,169
Motor starter, E. Schattner	816,383
Muffler, Hill & Dalgarno	816,231
Musical instrument solo attachment, F. A. Pilcher	815,978
Nail cap plate, G. R. Wyman	816,522
Nailing machine, H. W. Morgan	816,350
Nose ring, animal, R. I. Teeter	816,194
Nut, Schubert & Rechnitz	815,982
Nut lock, J. M. Scott	816,044
Nut lock, C. A. Allen	816,143
Nut wrench, axle, C. E. Slater	816,191

Over

$6,500,000

Given

to Policyholders

In Cash Dividends and Other Concessions

Since its Organization The Prudential has Voluntarily Distributed to Industrial Policyholders over

$6,500,000

More Than the Amount Called for by Their Policies

This is Liberality in the Full Sense of the Word

Life Insurance is One of the Best Investments in the World.

SEND TO-DAY FOR INFORMATION

Without committing myself to any action, I shall be glad to receive free, particulars and rates of Profit Sharing Policies.

For $ ..... Age .....
Name .....
Address .....
Occupation ..... Dept. 121

The Prudential

Insurance Co. of America
Incorporated as a Stock Company by the State of New Jersey

JOHN F. DRYDEN, President

Home Office: NEWARK, N. J.

Save Worry
SHEET METAL GAUGE

Measures in thousandths from 0 to ½ in. thickness and to 2 ins. from edge of sheet. In leather case, **$6.75.** Send for free catalogue No. 17 B.

The L. S. Starrett Co., Athol, Mass.

WARREN'S WALRUS ROOFING

Rain, snow, ice, wind, frost and summer sun are powerless against it. On a barn, a factory or a dwelling it will give perfect results for years after other roofings are worn out. Our free sample shows its value. Write for it.

WARREN CHEMICAL & MFG. CO.
18 Battery Place, New York

Alco Acetylene Gas Burners

For House Lighting or Auto and Yacht Lamps. Look better, last longer, burn brighter, and are cheaper than all others. Price $2.10 doz.

American Lava Company, Chattanooga, Tenn.

You need this knife on your automobile, in the shop and in your home.

A Veritable Pocket Tool Chest

9 TOOLS IN 1

The Wonder of the Age

Built as substantially as a locomotive. Weighs no more than an ordinary three blade pocket knife. Stag horn handle. In addition to the blade, which is made from 85 carbon cutler's steel, contains the following tools:

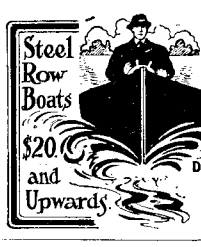
1, Leather Punch
2, Swedging Awl
3, Wire Cutter
4, Wire Pliers
5, Alligator Wrench
6, Hoof Hook
7, Screw Driver
8, Screw Bit

Cuts barbed fence wire as easily as an ordinary 8-inch plier. Hoof hook is of great value as a packing hook around the engine. The tools are needed almost every day, and in tinkering around your home the knife will be an invaluable pocket companion. **AGENTS WANTED**

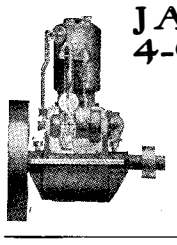
Remit $1.25 for sample to-day. Your money back if not satisfied.

This Knife for an Inventor or in a Model Shop is a Genuine Luxury

DEVINE SPECIALTY CO.
Dept. 11 83 Baldwin Building, Indianapolis, Ind.
REFERENCE: Columbia National Bank.



BABBITT METALS.—SIX IMPORTANT formulas. SCIENTIFIC AMERICAN SUPPLEMENT 1123. Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for catalogue.



JAGER Marine 4-Cycle Engines

Skillfully designed and well built. Single lever control, combining automatic carburettor with spark advance. Develops wide speed range and reliability under most trying conditions. Sizes 3 to 60 h. p. Send for catalog.

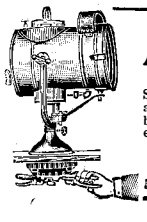
CHAS. J. JAGER CO.
Cor. High and Batterymarch Sts., Boston, Mass.

1906 THOMAS AUTO-BI

Model No. 44, Price $145

Three Horse Power. Simplest motorcycle on the market. Agents wanted everywhere. Catalog free.

THE THOMAS AUTO-BI CO.
1450 Niagara Street Buffalo, N. Y.



Clear View
Acetylene Searchlight

A neat, compact, self-generating, portable Searchlight of high power for yachts, launches and boats of all kinds. Useful in locating buoys, making landings, detecting obstructions, etc., should be part of every boat's equipment.

Write for Catalogue.

AMERICAN ACETYLENE STOVE CO.
503 Masonic Temp., Minneapolis, Minn.

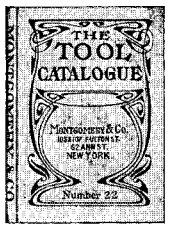
NEW YORK SCHOOL OF AUTOMOBILE ENGINEERS

Incorporated
147 West 56th Street, New York City
Under the personal direction of
PROF. CHAS. E. LUCKE, M. E., Ph.D.
School of Engineers, Columbia University

Departments include machine tool and forge shops assembling and test shops, and every type of motor; also laboratories completely and specially equipped to teach all component parts of automobiles.

Day and Evening Classes.
SPECIAL COURSES FOR OWNERS.

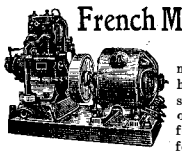
Tools! Tools! Tools!



and all you want to know about them. Our Tool Catalogue No. 22 is a cloth-bound book of 950 pages. If you want to "know it all" about Tools you should send for this book at once. Sent post-paid on receipt of $1.00 which will be refunded from your first purchase from us of $10.00 or over.

MONTGOMERY & CO.
105 Fulton Street, N. Y. City

French Motors for Lighting Plants



The **"ASTER"** is the best French motor on the market for lighting houses, hotels, etc. Small, compact, simple and safe to operate. Motive power alcohol, oil or gas. 2 and 4 cylinders. Great power for small engines. Easy running. Write for illustrated Price List.

ASTER COMPANY
1591 Broadway NEW YORK CITY

A Fay & Bowen Engine

Took One First and One Second Prize in the Palm Beach Races in February.

A Fay & Bowen Engine came in first in the Chicago-Mackinaw Endurance run last Summer, running the 39 hours without a single stop.

A *Reliable* Two-Cycle Machine, started without a crank.

Our unique Make-and-Break Sparker is admitted to be the best.

Write for free catalogue of Motors and Fine Boats . .

Fay & Bowen Engine Co.

80 Lake Street, GENEVA. N. Y.

16 FOOT LAUNCH COMPLETE WITH ENGINE $96

WE ARE THE LARGEST BUILDERS OF BOATS & LAUNCHES IN THE WORLD

SEND FOR FREE ILLUSTRATED CATALOG

ALL BOATS FITTED WITH WATER TIGHT COMPARTMENTS CAN NOT SINK.

WE CARRY A FULL LINE OF BOATS READY TO SHIP.

MICHIGAN STEEL BOAT CO. 1425 JEFFERSON AVE DETROIT MICH

Washburne's Patent

"O.K." PAPER FASTENERS

The "O. K." has the advantage of a tiny but mighty, indestructible piercing point, which goes through every sheet, co-acting with a small protecting sleeve to bind and hold with a bull-dog grip. No slipping. Handsome. Compact. Strong. Easily put on or taken off with the thumb and finger, can be used repeatedly, and they always work. Made of brass. Three sizes. Put up in brass boxes of 100 Fasteners each. At all enterprising stationers Send 10c. for sample box of 50, assorted sizes. Booklet free. Liberal discount to the trade.

JAMES V. WASHBURNE, Mfr. 240 E. Genesee St., Syracuse, N. Y.

PORTABLE CONCRETE

Block Machine

Ambitious young men can start fine business, immediately profitable, easily expanded

Blocks cost 6 cents to make, sell for 18 cents. One man can make 200 blocks per day. Whole outfit costs $125.00.

Sand, water and Portland cement only materials required.

Sent on trial.

THE PETTYJOHN CO.

615 N. 6th St., Terre Haute, Ind.

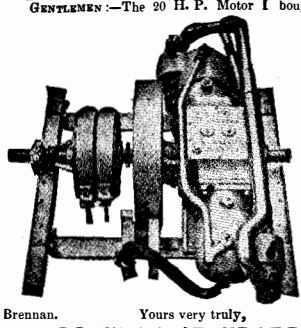
CLINTON, MICH., Dec. 21, 1905.

BRENNAN MOTOR CO., Syracuse, N. Y.

GENTLEMEN:—The 20 H. P. Motor I bought of you three years ago, to run my ice harvester, is a dandy. It is simple, easy to control and cheap as to fuel.

I did my threshing with it, running a large separator, with blower for stacking, and it seemed to run with as much power, if not more, than the large steam engine. Crowds of people came to see the little thing run such a large machine and do the work so easily. It took about three hours to thresh over 400 bushels of grain and we did not stop once.

Any one wanting a motor will make no mistake if they get a Brennan.



Yours very truly, J. B. HAUSE.

BRENNAN STANDARD MOTOR

Mounted with Individual Clutch Gear, also Furnish Sliding Gear Transmisson.

Motors from 6 to 80 Horse Power.

CEMENT BLOCK MACHINE $50

Complete Outfit. Capacity 150 a day, 2 men.

Cement Brick Machine $25

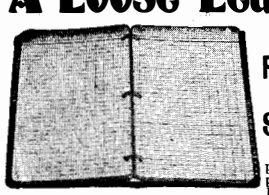
Capacity 1200 a day, 1 man.

Tamped face down, any design.

MOLDS for Cisterns, Tanks, Silos, Fence Posts, Drain Tile, etc.

A. D. Mackay & Co., 84 Washington St., Chicago

A Loose Leaf Book



PERFECTLY Flat-Opening AND Self-Indexing

Most convenient for price books, route books, pocket ledgers, meter books, engagement books and all forms of records which should be kept in convenient, accessible form. Better than any card index. These "Unimatic" books are bound in full, genuine, flexible, black leather, are **perfectly flat opening and sheets may be instantly inserted or removed from any part.**

The following sizes sent postpaid on receipt of price:

USE	No.	Binding Edge	Size of Sheet	Capac. of Cove Inches	Capac. of Cove Leaves	Complete
Vest Pocket	212	2	2 x 4	⅛	50	$0.85
" "	4412	4½	4½ x 2½	⅛	50	.95
Coat Pocket	612	6	6 x 3½	⅛	50	1.20
" "	532	5½	5½ x 3	⅛	125	1.70
" "	632	6⅝	6⅝ x 3⅜	⅛	125	1.75
" "	7732	7⅝	7⅝ x 4⅜	⅛	125	2.10
Desk	1132	11	11 x 8½	⅛	125	3.90

19 other sizes carried in stock

Stock ruling: Quadrille, Unruled, Dollars and Cents, Faint Lines, Double Entry Ledger and 4-Column Price-Book Ruling.

Send for sample sheets and complete catalogue of the largest line of loose-leaf devices in the world.

Sieber & Trussell Mfg. Co., 4002 Laclede Ave., St. Louis

Oil saver, W. A. Williamson	816,284
Ore separator, magnetic, R. R. Moffatt	816,491
Ores, treating, Baker & Burwell	816,061
Packing ring, H. Kirschning	816,478
Packing, steam turbine, R. A. McKee	815,973
Paint, varnish, etc., composition of matter for removing old, A. Neidhardt	816,359
Paper bag machine, F. E. Strasburg	816,193
Paper box or container, J. C. Kimsey	816,338
Paper carton, L. G. Reynolds	816,124
Paper for lithographic prints, producing, L. W. Noyes	816,497
Paper making machine, C. Tittel	816,402
Paper tray, F. B. Davidson	816,302
Peat oven, P. J. Buckley	816,214
Pedal, extension, H. Taussig	816,512
Pelt cleaner, J. Hemingway	816,466
Pen filling device, fountain, R. G. Lockwood	816,345
Pen, fountain, W. N. Lancaster	816,344
Pen wiper, J. R. Foster	816,086
Percolator, C. E. Trewhella	816,514
Photographic films, developing receptacle for, S. W. Smith	816,392
Pipe joint, M. Dean	816,155
Pipe joint, separable, A. C. Lynch	815,968
Pipe system, stand, W. F. Conran, Jr	816,152
Plane, carpenter's, A. Kalla	816,335
Plaster and mortar, apparatus for mixing and making, A. Dellamore, et al	816,156
Plastering construction, J. Barbagelata, Jr.	816,420
Plastic material, treating, A. A. Scott, 815,385 to	816,387
Pliers, A. Tracht	816,278
Plow, H. Morton	816,173
Plow, R. Nelson	816,360
Plow, H. Wiard	816,518
Plow, subsoil, J. B. Harris	816,548
Plowing attachment, rotary disk, Erb & Powlison	816,543
Pneumatic alarm, J. Cairns	816,430
Pneumatic despatch apparatus, F. S. Smith, 816,261,	816,262
Power transmission means, A. J. Lindsay	816,022
Press, Fiddyment & McNally 816,446,	816,447
Printer's galley, J. P. Rivett	815,980
Printer's quoin, H. A. Hempel	816,324
Printing and numbering machine, time, J. C. Wilson	816,202
Printing machine, G. A. Main	816,110
Printing roller composition on fabrics, mold for depositing, J. F. Ames	816,144
Projectile and its band, Wheeler & McKenna	815,992
Propeller, G. Mechtersheimer	816,347
Propeller for boats, steering, H. W. Hellmann	816,163
Propelling mechanism, F. Pelissier	816,368
Puller. See Spike puller.	
Pulley block, W. S. Tuttle	816,196
Pulley, expansible, C. J. Reed	816,184
Pulley, split, O. A. Nelson	816,117
Pump, G. W. Kellogg	816,476
Pump, C. F. Wray	816,520
Pump apparatus, computing, F. P. Dunn	816,305
Pump, double-acting deep well, Berry & Sturgeon	816,064
Pumps and the like, making leather packing rings for hydraulic, J. B. Walsh	816,197
Radiator air valve, steam, J. L. Judge	816,475
Rail and spike brace, combined, Freeman & Zortman	816,452
Rail cleaning apparatus, Lindall & Winsor	816,485
Railway carriages, simultaneous locking of doors of, N. Dewhurst, et al	815,943
Railway, pleasure, Taylor & Hoard	815,986
Railway rail joint, H. Cramer	816,533
Railway rail stay, H. H. Sponenburg	816,265
Railway road beds, apparatus for raising the superstructure of and ballasting, G. H. Cravens	816,076
Railway spike and tie plate, T. G. Peterman	816,370
Railway switch, H. Raymond	816,254
Railway switch, A. A. Shaw	816,257
Railway tie, W. I. F. Harden	816,463
Railway tie and rail brace, sheet steel, F. McCune	815,972
Railway track supporting device, J. T. Cochran	816,004
Rake, G. M. Long	816,486
Ram, hydraulic, H. V. Blake	816,145
Razor, safety, R. S. Wiesenfeld	816,141
Razor, safety, J. Turner	816,195
Razor, safety, F. A. Clauberg	816,299
Reamer and die stock, combined, J. J. Delehant	816,304
Reel, J. D. Holt	816,328
Relay device, reverse, R. D. Mershon	816,111
Resaw, band, J. L. Graham	815,955
Revolver ejector mechanism, J. D. Robertson	816,125
Rheostat, C. Wirt	815,996
Rivet holder, magnetic, H. B. Douglas, 816,540,	816,541
Road sweeper, C. J. Ewart	816,082
Rock drill or rock drilling machine, Hellman & Bayles	816,090
Rocker attachment, P. J. Geyler	816,088
Rotary engine, I. Abbott	816,285
Rotary engine, D. F. Baker	816,288
Rotary motor, J. K. Broderick	816,147
Rule holder, pocket, R. D. Fassett	816,544
Rule or gage, R. W. Douglas	815,944
Saddle, harness, G. L. Forman	816,450
Safe or vault door bolt construction, J. H. Williams	816,519
Sash cord fastener, window, C. J. Weinman	816,283
Sash fastener, McKinney & Henderson	816,116
Sash, window, L. B. Rodery	816,187
Saw guard, J. G. Hill	816,326
Saw set, F. A. Wuest	816,054
Saw teeth, side dressing tool for, R. C. Charlton	816,433
Saws, adjustable fence for, T. Bemis	816,424
Scaffold support, A. O. Gardiner	816,458
Scale, computing, J. Hopkinson	816,093
Scalp comb, L. W. Dehart	816,221
Screw machine, automatic, C. M. Spencer	816,510
Screw machines, threading mechanism for automatic, C. M. Spencer	816,393
Seal, bottle, Mercer & Orchard	816,489
Sealing apparatus, envelop, J. E. Nachod, 816,175,	816,176
Sealing bottles or similar articles, closure for, F. B. Thatcher	816,513
Sealing boxes, etc., means for, A. Freschl	816,007
Sealing device, F. W. Purcell	816,376
Seat back, B. L. Field	816,545
Seat structure, spring, J. H. Cook	816,075
Seeding machine speed device, Jones & Towle	816,331
Separator. See Cream separator.	
Separator, G. Boettler	816,067
Separators, automatic distributor for blower, Beisendorfer & Allen	816,460
Sewing machine stand, G. D. Cooper	816,300
Shade, Haight & Chapman	816,316
Shade cloth trimmer, F. W. Orchard	816,247
Shaft, flexible, C. F. C. Mehlig	816,240
Shaft supporter, C. J. Murphy	816,027
Shearing machinery, lappet, W. C. Bradley	815,938
Shutter, fire, B. C. Donnelly	816,080
Shuttle, N. Foerster, et al	815,953
Shuttle box, D. J. Carey	815,939
Shuttle box, N. Foerster, et al	815,950
Shuttle for weft replenishing mechanisms, N. Foerster	815,949
Sidewalk, floor, and roof light construction, P. H. Jackson	816,234
Sifter, rotary flour, G. J. Sweeten	816,136
Singeing machine, H. Kraemer	816,018
Smoke stack, W. G. Wallace	816,051
Soap, brush, H. A. Burt	816,002
Sound producing instrument, C. A. Parsons	816,180
Spectacles, H. Newbold	815,975
Speed changing device, O. F. Persson	816,369
Speed meter, R. W. Hargrave	816,089
Spike puller, D. Auer	816,287
Spinning frames, curved fly remover for, R. Obernesser	816,031
Spool holders, combined weight and flier for, A. H. Groel	815,956
Stamp mill, M. P. Boss 815,936,	815,937
Stanchion, Williams & Edgar	815,994
Steam boiler, S. H. Hale	816,012
Steam boiler, C. C. Cherry	816,530
Steam engine, compound, W. Wills	816,411
Steam trap, W. S. Johnson	816,474
Stereotypes and the like, manufacture of, R. C. Annand	815,999

Hair Life Revives

Under the Evans Vacuum Cap. Guarantee Backed by a Bank.

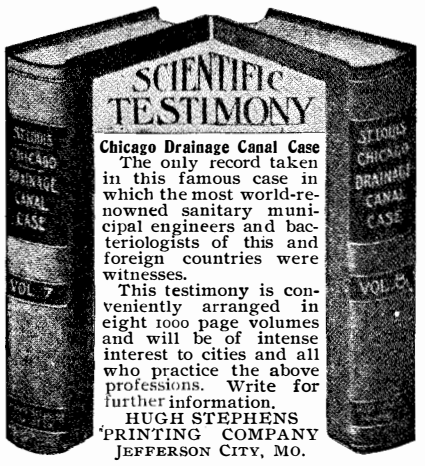
The scientific reason for a new hair growth by the EVANS VACUUM CAP method, is simply in that the exhaust of air brings a full supply of blood to the scalp, which acts like a rhythmical massage. You can tell from using the Cap a reasonable length of time what your result is going to be; if you experience the tingling, freshening sensation of renewed circulation and a healthy, ruddy tinge shows on the scalp surface, it is proof positive and scientific evidence that nature is still able to do her work in the production of hair growth, and the Cap will restore your hair.

The EVANS VACUUM CAP method is endorsed by scientists generally, and is guaranteed to produce a growth of hair to your satisfaction or your money will be refunded by the Jefferson Bank of St. Louis. When you make up your mind send your money to the bank to hold—don't send it to us. We agree to send you the Cap on sixty days free trial (by prepaid express) and if at the end of that time you are not convinced that the Cap will restore your hair, notify the bank and return the Cap to us. The bank will refund your money in full.

We have no agents or traveling representatives, all orders come through the Jefferson Bank.

A 16-page Illustrated Book Will be Sent You on Request, Postage Prepaid in Full by Us.

EVANS VACUUM CAP CO., 412 Fullerton Building, ST. LOUIS, MO.



The only record taken in this famous case in which the most world-renowned sanitary municipal engineers and bacteriologists of this and foreign countries were witnesses.

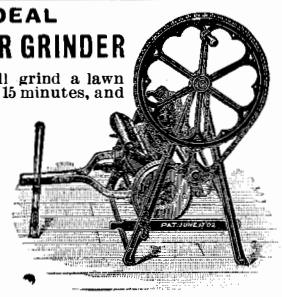
This testimony is conveniently arranged in eight 1000 page volumes and will be of intense interest to cities and all who practice the above professions. Write for further information.

HUGH STEPHENS PRINTING COMPANY
JEFFERSON CITY, MO.

MENNEN'S BORATED TALCUM
TOILET POWDER
TRADE MARK
A Positive Relief For
CHAPPED HANDS, CHAFING and all skin troubles. "A little higher in price perhaps than imitations, but a reason for it." Delightful after shaving and after bathing. Sold everywhere, or mailed on receipt of 25c. Get Mennen's (the original). Sample free
Gerhard Mennen Company, - Newark, N. J.

THE IDEAL

LAWN MOWER GRINDER



This machine will grind a lawn mower perfectly in 15 minutes, and is destined to revolutionize the whole business. Greatly improved over old models, and is now perfection. Energetic men and boys make $10 per day using it. Nothing like it on the market. For Hand or Power use. For prices, etc., address the manufacturers.

THE ROOT BROS. CO., Plymouth, Ohio

HOW TO MAKE AN ELECTRICAL Furnace for Amateur's Use.—The utilization of 110 volt electric circuits for small furnace work. By N. Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by any amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1182. Price 10 cents. For sale by MUNN & Co., 361 Broadway, New York City, or by any bookseller or newsdealer.

"Economo" Emery Wheel Dresser

SIZE 12 IN.

Economo "Combination" Dresser

Made of an abrasive nearly as hard as a Black Diamond. Will true or shape any wheels except the very hard. The "Combination" is a roughing tool placed in one end of "Economo." Send for circular. Dresser sent on approval.

INTERNATIONAL SPECIALTY CO., 360 Holden Ave., Detroit, Mich.

DO YOU USE GRINDSTONES?

If so we can supply you. All sizes mounted and unmounted, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. *Send for catalogue "I"*

The CLEVELAND STONE CO.

2d Floor, Wilshire, Cleveland, O.

We make motors, generators, dynamos, and supply complete outfits, including gas and gasoline engine for mills, factories and all lighting and power purposes. Sizes from 1-4 H. P. to 1,000 H. P. and from 10 to 1,000 light capacity. Write for complete catalogue everything electrical.

NATIONAL STAMPING AND ELECTRIC WORKS

62 S. Clinton St., Chicago

A Sterling Silver Cigar Cutter

that is really worth more than the price you pay for it—appreciated by every smoker. Cuts clean and never tears. Simple, unique and strong.

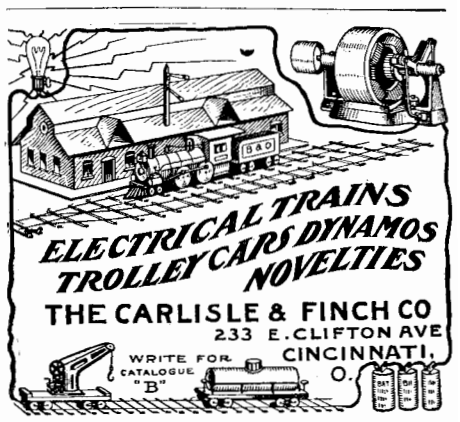
For One Dollar

you can have this cutter delivered to your address postpaid in any part of the United States, if your jeweller cannot supply you. Our guarantee of satisfaction goes with every sale.

The R. S. Cigar Cutter

Sent postpaid to any address on receipt of **One Dollar.**

F H DICKSON, 22 Hay's Bldg., Maiden Lane, N. Y.



The "Best"

The World's Best Light

Sold in every civilized country on earth. Costs less than kerosene, gives six times more light than electricity.

A Pure White Steady Light

Makes and burns its own gas. No wick, no odor, no smoke. Absolutely safe. For indoor and outdoor use,

Agents Wanted,

Exclusive territory, liberal commissions. Catalog free.

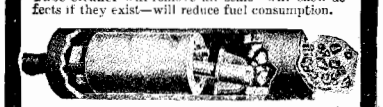
THE BEST LIGHT CO.

Owners of Original Patents.

87 E. 5th St. CANTON, OHIO.

Clean Boilers Are Safe Boilers. Clean Boilers Require Less Fuel

Are your boilers FREE of scale? The Dean Boiler Tube Cleaner will remove all scale—will show defects if they exist—will reduce fuel consumption.



We will loan you a Cleaner for FREE TRIAL to prove its worth. Send size of tubes to-day and ask for book, "Boiler Room Economy." It tells all about scale.

WM. B. PIERCE & CO.

319 Washington St., Buffalo, N. Y.

MUD FORGET IT AND USE

WEED'S TIRE GRIPS

Positively Stops Slipping or Skidding

They Make Bad Roads Good

Send for Booklet "S"

WEED CHAIN TIRE GRIP COMPANY

28 Moore St., New York City

Stallman's Dresser Trunk

Easy to get at everything without disturbing anything. No fatigue in packing and unpacking. Light, strong, roomy drawers. Holds as much and costs no more than a good box trunk. Hand-riveted; strongest trunk made. In small room serves as chiffonier. C. O. D. with privilege of examination.

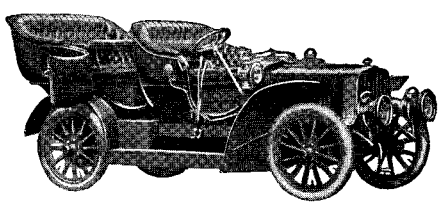
2c. stamp for Catalog.

F. A. STALLMAN, 61 W. Spring St., Columbus, O.

MANUFACTURERS!
You can make and market the
GEM CITY WIND MILL
at prices so low as to guarantee large returns. Steel and iron construction throughout; triangular shaped, open, steel tower; ball-bearing, sensitive turn table; wheel always to wind; few working parts; easily lubricated; best—simplest—cheapest—strongest. Patents for sale—Write today.
Dayton Supply Co., Dayton, Ohio.

For 1 Mile or 1,000 Miles

The Type XII, Pope Toledo, is the Fastest, Most Powerful Stock Touring Car in America



35-40 h.p. Full Equipment
Price $3,500

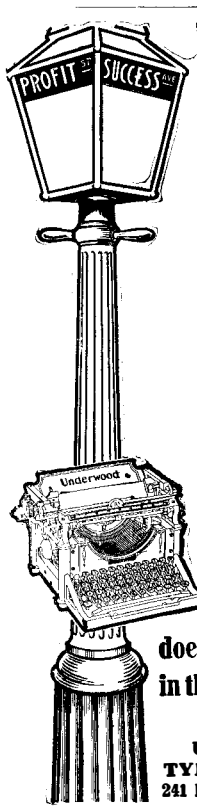
PLEASE note carefully that we say one mile or a thousand miles—Moreover, the Type XII, 35-40 h.p. Pope-Toledo, will run more miles at less cost for tires, fuel and repairs, and with less adjusting than any high powered touring car in the world. Transmission is made of the new chrome nickel steel, having a tensile strength of 225,000 pounds, and is, without question, the strongest, most silent and smoothest running transmission ever placed in an automobile. This year we have adopted the "I" Beam form of axles, drop forged in our own plant from steel having a tensile strength of 110,000 pounds. Both foot and emergency brakes act on the rear hub bands, thus relieving all brake strain and wear on the transmission. Engine throttles down to a point making it possible to drive behind a team walking, or gives the maximum efficiency of the engine all on the high gear. Catalogue of 20-25; 35-40; 40-50 and 60 h. p, Touring Cars, Limousine and Runabouts, on request.

Be Sure the name "POPE" is on Your Automobile

POPE Toledo AUTOMOBILES

Pope Motor Car Co.
Desk 2, Toledo, O.
Members A. L. A. M.
BOSTON, 223 Columbus Ave.
NEW YORK, 1713 Broadway
WASHINGTON, 819 14th St., N. W.

ELECTRIC SEWING MACHINE MOTOR.—The instructions and numerous illustrations of details contained in this article will enable any mechanic of average ability to build an efficient motor that will operate a sewing machine. The cost of materials for this machine should not exceed five dollars. See SCIENTIFIC AMERICAN SUPPLEMENT, No. **1210.** Price 10 cents by mail, from this office and from all newsdealers.



REAL MAIL SERVICE

Your office efficiency is determined by your "mail" i. e., the way your Brains are put through your Typewriter. If you lack either, the other's small value. The best commercial brains in the world have decided the

VISIBLE WRITING

Underwood Typewriter

does the best work in the shortest time

UNDERWOOD TYPEWRITER CO., 241 Broadway, New York.

Stone post or column, artificial, N. Michelena e Inarra	816,171
Stone shingle, artificial, O. Price	816,252
Stool, folding, C. Erickson	816,158
Stove, magazine heating, E. D. Marshall	816,024
Stove, oil, W. H. Wilder	816,201
Stuffing box, J. Sieger	816,190
Stuffing box, F. W. Felsberg	816,445
Surgical clip, A. J. Meier	816,026
Surveying instrument attachment, W. M. Beaman	816,422
Swaging mill, G. H. Blaxter	816,146
Sweat band, R. H. & H. D. Curtis	816,301
Swingletree attachment, W. C. Pritchard	816,501
Switch, M. S. Farmer	816,308
Switch, H. Richardson	816,377
Talking machine horn support, E. S. Oliver	816,178
Tape stretcher, G. Oertel	816,032
Teaching the fundamental operations with numbers, device for, C. Zahn	816,204
Telegraph receiving apparatus, wireless, A. Artom	816,205
Telephone and watchman's alarm system, combined, J. J. Berry	816,000
Telephone exchange system, H. G. Webster	816,052
Telephone exchange system, W. M. Davis	816,078
Telephone exchange system, H. D. Stroud	816,135
Telephone exchange systems, transfer circuit for, C. A. Simpson	816,131
Telephone system, C. B. Smith	816,132
Telephone time register, G. Furst	816,456
Temperature regulating apparatus, J. A. Serrell	816,046
Theaters, etc., means for quickly emptying crowded, L. Wittenberg	815,997
Tire, C. W. Faitoute	816,225
Tire armor, H. E. Prouty	816,182
Tire tool, vehicle, McCarthy & Phenice	816,354
Tire valve, C. E. Duryea	816,006
Torch and soldering iron, combined hand, E. Block	816,425
Torch, marine, J. D. Graham	816,160
Torpedoes, retarding device for automobile, F. M. Leavitt	816,019
Toy bank, C. A. Bailey	815,935
Toy, inflatable, C. A. Lindsay	816,106
Track brake, J. M. Cook, Jr	816,531
Track clearing device, C. C. Battey	816,208
Traction increasing mechanism, F. L. Sheldon	816,505
Transmission element, frictional, P. Sechiari	816,388
Transplanting device, R. D. Kline	816,236
Tree. See Boot and shoe tree.	
Tripod, camera, O. W. Steindorf	816,268
Trolley, Zander & Hahn	816,415
Trolley harp, I. H. Lunt	816,239
Trolley pole, A. S. Weaver	815,991
Trolley shield, Brown & Jenkins	816,148
Trolley track, overhead, C. G. Schmidt, et al	816,255
Trolley wire suspension, system of, P. E. Herkner	816,467
Truck bolster, J. M. Goodwin	816,010
Truck, car, Brill & Curwen	816,294
Trunk tray support, A. S. Belber	816,423
Tubes, implement for truing the internal forms of, F. A. Forwood	816,451
Tug, shaft, F. Davis, Jr	816,439
Turbine, fluid pressure, G. Westinghouse	816,516
Turbine guiding means, H. Lentz	816,020
Turbine, steam, C. F. Barth	816,207
Turbine, steam, D. Lumgair	816,487
Typewriters, card holding device for, J. C. McLaughlin	816,174
Typewriting machine, L. Ney	816,118
Typewriting machine, F. X. Wagner, reissue	12,465
Valve, back pressure, A. W. Cash	816,216
Valve, cylinder compression relief, J. W. Miller	816,348
Valve, exhaust controlling, W. J. Inman	816,098
Valve, flush, E. D. Barrett	816,290
Valve for air brake systems, pressure retaining, W. Wilhelm	816,409
Valve for pneumatic tools, throttle, R. A. Norling	816,246
Valve mechanism, J. A. Dyblie	816,306
Valve mechanism for gas engines, Smith & Welcome	816,047
Valve throttle, J. S. Chambers	816,217
Valves, diaphragm for controlling, L. B. Fulton	816,455
Vats, system of excavating and filling, H. W. Blaisdell	816,065
Vault light, McGuigan & Priddle	816,115
Vehicle bearing spring, motor, T. G. Stevens	816,396
Vehicle, dumping, J. M. Goodwin	816,009
Vehicle heater, Swengel & Byrne	816,397
Vehicle, motor, C. M. J. Petiet	816,250
Vehicle running gear, motor, R. B. Vaughn	816,282
Vehicle storm shield, M. R. Hull	816,013
Vehicle wheel, R. S. Bryant	816,149
Vehicle wheel, J. C. Schleicher	816,189
Vehicles by fluid pressure, apparatus for operating dumping, J. M. Goodwin	816,008
Vending machine, coin controlled, S. L. Long	816,107
Vending machine, coin controlled, F. W. Tucker	816,515
Ventilator lifter, C. A. Black, Jr	816,212
Venturi tube, A. S. Tuttle	816,280
Vise, bench, C. Hanimann	816,162
Vise, parallel bench, W. H. Snow	816,508
Wagon brake, W. F. Jennings	816,099
Wagon tipping device, C. Pay	816,035
Wall tie, G. H. Charls	816,297
Washing apparatus, fabric, I. E. Palmer	816,179
Washing machine, C. O. Frostenson	816,454
Waste trap, W. H. Lloyd	816,023
Watch, A. Wagner	815,989
Watch, remontoir winding, F. Hartmann	816,321
Water, apparatus for producing boiling, H. Junkers	816,101
Water by electrolysis, apparatus for decomposing, W. F. M. McCarty	816,355
Water closet, J. Rhead	816,185
Water glass guard, G. C. Jones	816,016
Water purifying apparatus, J. H. McDonald	816,357
Weather strip, F. Y. Dawson	815,941
Well drilling machine, W. L. Knowles	816,341
Wells, branch clamp for oil, R. B. Nelson	816,361
Wheel. See Car wheel.	
Wheel gage, R. L. Ervin	816,159
Wind motor, J. C. Ziegler	816,524
Windmill governor, P. B. F. Born	816,213
Windmill regulator, F. E. Kronquest	816,167
Window, D. R. Caler	816,431
Window construction, W. H. Miller	816,241
Window lock, J. Killmeyer	816,337
Window, sheet metal, V. Ross	816,126
Window stop and guide, metal, V. Ross	816,041
Wire fabric making machine, W. N. Parrish	816,034
Wire stretcher and splicer, combined, A. & C. A. Church	816,298
Wood articles, machine for shaping, J. H. Neville	816,030
Woodworking clamp, G. Gustaveson	816,011
Woodworking machine, F. Diehl	816,079
Wrench, S. E. Coffman	816,151
Wrench, C. C. Dotson	816,157
Wrench, J. G. Wilson	816,203
Wrench, W. H. Claflin	816,434
Wristlet, W. E. Wolff	815,998

DESIGNS.

Automobile body, P. W. Steinbeck....37,928,	37,929
Badge, J. B. Goodwin	37,914
Barometer case, E. Wolfstein	37,919
Eyelet, G. A. Langmaid	37,918
Fabric, printed textile, E. B. Vandergaw	37,930
Furnace front, heating, C. Smith	37,927
Gas globe, incandescent, S. Mason	37,925
Goblet, A. Pick	37,917
Illuminator, O. A. Mygatt	37,924
Ring, Carr & Rushton	37,915
Ring, A. A. Dorst	37,916
Stove, gas, L. Stockstrom	37,926
Tool handle, J. J. Tower.....37,920 to	37,923

TRADE MARKS

Ale, carbonated ginger, Lowenstein & Co	50,683
Anesthetics, local, B. B. Lawrence	50,725
"Anti-set-off" composition, American Offset Co.	50,710
Antiseptic and germicide, alkaline, Girard Co.	50,719
Anvils, Wiebusch & Hilger	50,635

This Razor must Pay for Itself before You Pay me a Penny

—and a Postal gets It. I Guarantee to Keep your Blades Sharp Forever Without Charge.

I am the man you hold personally responsible for every promise made in this advertisement.
P. C. SHERMAN.

WILL you let me send you a razor—without a cent deposit?

Then I will keep it sharp and keen for the rest of your life *free.*

That's my plan—my new plan of selling razors.

No other razor maker in the world sells razors this way—because they can't—their razor won't stand it. Mine will—it's the way it's made.

I don't say "Send me the price of the razor, and if, after you have tried it, you find that it isn't all I claim, I will send your money back."

—Not me.

On a "money back" proposition you may feel that there is some chance of not getting your money back if you wanted it—I won't let you feel that way about my razor.

For if the razor don't do all I say you send it back at my expense and you're out nothing, for you've paid me nothing and you owe me nothing.

Now, simply do this—Send me your name, occupation, home and business address—and in any manner that is convenient or agreeable, introduce yourself to me.

I'll take all the risk and send, prepaid, a Sterling Safety Razor with 24 blades, or a Sterling Old Style Interchangeable Razor with 12 blades.

When you have tested it 7 days, if you find it the finest and easiest shaving razor you ever used, keep it.

Then the razor must pay for itself—*that's* my new plan.

You see the average man should be shaved at least three times a week—at 15c. a shave that's 45c. a week for shaving.

So, if you decide to keep the razor all I ask you to pay me is what you'd pay the barber—45c. a week for a few weeks until the razor is paid for.

That way I make the barber buy you the razor.

At that, my razor does not take any more money to pay for itself than you would have to pay out of your own pocket for an ordinary razor.

And I go even farther.

I see to it that your blades are kept sharp forever—free.

With any other razor you are always paying out money because you must keep on paying for new blades or resharpening as long as you live.

But with the Sterling—

All you do is send me 12 dull blades at any time, with 10 cents to cover postage, and I return them to you perfectly sharp free of charge.

That's really "no honing and no stropping."

Did you ever hear of anything as clever as this in the razor line?

It's this way—the reason I can make this offer is because I'm not in the least doubtful or afraid of my razor.

My STERLING blades are made of the finest razor steel that money can buy—costs me twice as much as the steel used in any other razor blades.

And mine is the only razor on the market that is made of genuine Sheffield steel—that is not a cold rolled steel.

With my careful, systematic process, each STERLING blade is hardened, tempered, ground and honed in oil all by hand, then hand stropped—so that my razor *must* hold its edge.

And each of my STERLING blades must pass the SHERMAN test, the most rigid test to which a razor blade can be subjected.

No other razor blade could pass this test.

But I *must* make certain that the temper and cutting edge of every STERLING blade are perfect and lasting.

I cannot afford to pass any but faultless razor blades, because my razor is made to shave with, and not made to sell.

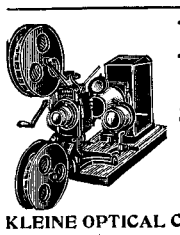
And because of all this I can afford—and am glad—to send you the razor, prepaid, for free trial without any deposit but your name, address and the introduction. If you forget the introduction I'll have to write for it and that will delay the razor.

You can buy the Sterling Razor for **$5.00,** but I am willing to send it to you and let it pay for itself.

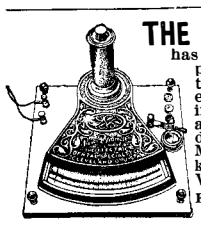
Now—write me to-day, stating whether you wish the Safety or Old Style Interchangeable, and let me send you the razor. State whether you wish to cut close or medium, and whether your beard is wiry or fine. Don't send me any money—only a postal.

Remember the razor is yours for a week free—then either keep it and let it pay for itself with the guarantee that I must keep the blades sharp forever—free—or return it to

P. C. SHERMAN, Pres., 288 Water St., N. Y.

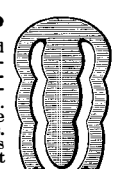


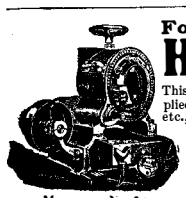
Motion Picture
MACHINES and FILMS
STEREOPTICONS and SLIDES
For Public Entertainments, in Theatres, Halls, Show Tents, etc.
Catalogue No 9 Free
KLEINE OPTICAL CO., 52 State St., Chicago, Ill.



THE PRICE PYROMETER
has revolutionized all methods of pyrometry. This instrument is the most efficient and reliable ever invented for the purpose, indicating temperatures as high as 800 to 3000 Fahr. Attractive, durable and highly sensitive. Manufacturers guarantee to keep it in order for one year. Write for particulars and prices.
ELECTRIC DENTAL SPECIALTY CO. 2241 Euclid Ave., Cleveland, O.

THE EUREKA CLIP
The most useful article ever invented for the purpose. Indispensable to Lawyers, Editors, Students, Bankers, Insurance Companies and business men generally. Book marker and paper clip. Does not mutilate the paper. Can be used repeatedly. In boxes of 100 for 25c. To be had of all booksellers, stationers and notion dealers, or by mail on receipt of price. Sample card, by mail, free. Manufactured by **Consolidated Safety Pin Co.,** Box 121, **Bloomfield, N. J.**



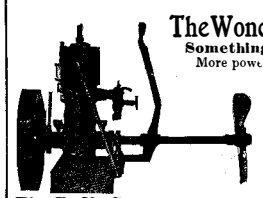


For Either **Hand or Power**
This machine is the regular hand machine supplied with a power base, pinion, countershaft, etc., and can be worked as an ordinary power machine or taken from its base for use as a hand machine. Length of pipe handled easily in small room. Illustrated catalogue—price list free on application.
MACHINE No. 78. Range 2½-4 in. R. H.
THE CURTIS & CURTIS CO.,
6 Garden St., BRIDGEPORT, CONN.

Convert Your Bicycle Into a Motorcycle

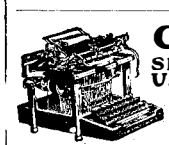
at small cost by attaching **the self-starting ERIE 2 H. P. Power Outfit.** This includes all parts by which anyone can easily make a **powerful, durable motorcycle.** weight 48 lbs. Bolts to frame. Speed 2 to 30 miles an hour. A hill climber. Hundreds in use. Send stamp for outfit catalogue.
MOTORCYCLE EQUIPMENT CO., Hammondsport, N. Y.

The Wonder Gasoline Motors
Something New and Up-to-date



More power for less money than any other machine on the market. No valves, gears, etc., to get out of order. Jump Spark. Our 1½ H. P. marine outfit is a "WINNER." Solid or reversing propeller. Our prices will surprise you. Write to-day. Marine or stationary outfits to suit any requirements up to 5 H. P.
The R. M. Cornwell Co., 406 S. Salina St., SYRACUSE, N. Y. 434 Park Row Building, New York

Clearing Sale Slightly Used Typewriters

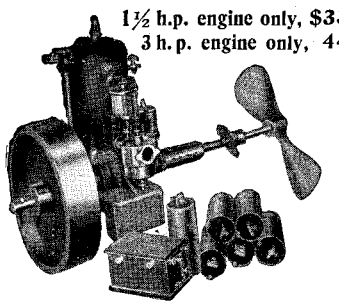


We own and offer as wonderful bargains, 1,500 typewriters which have been used just enough to put them in perfect adjustment. **Better than new.** Shipped on approval, free examination. 1,000 new *Visible Sholes* machines, built to sell for **$95**—our price while they last, **$45.**
FREE catalogue containing unparalleled list of splendid typewriter bargains. Send for it **to-day.**
Rockwell-Barnes Co., 859 Baldwin Bldg., Chicago, Ill.

BARKER MOTORS
Reliable.--1¼ to 10 H. P--Economical

Their perfect operation and reliability are due to common sense mechanical ideas and good construction. While low in price, they are made of best materials with careful attention to details.
C. L. BARKER, NORWALK, CONN.

1½ h.p. engine only, $33.15
3 h.p. engine only, 44.00



DETROIT AUTO-MARINE Motor New Model 1906

Always Right

The uncertainty of running is all taken out in the building.

The breakdown habit has been overcome by following scientific lines of construction proven by practice to be correct.

We take no chances and allow no guesswork to enter into their make-up.

All materials are tested for soundness and strength on a testing machine and the engines warranted to do all we claim for them. We are making 10,000 Auto Marine Gasoline Engines this year, manufacturing the motor complete from foundry to finished engine, not merely assembling parts made in various factories, and that is why we are able to sell a first-class motor with a guarantee at

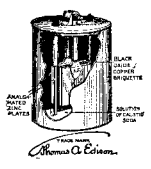
1½ H.P., $33.15. Engine only
3 H. P. will develop 4 H. P., $44.00. Engine only

Catalog with full information 1 to 20 H. P. Motors for the asking.

DETROIT AUTO MARINE CO.
75 E. Congress St., Detroit, Mich.
95 Liberty Street, New York
The Bourse, Philadelphia
The only builders of Auto Marine Engines in the World

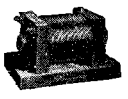
A Perfect Ignition Device

For Gas and Gasoline Engines



is the Edison Battery and Spark Coil. Ensures constant speed in Gas Engines and Motor Boats. The Batteries deliver a high constant current to the coil which is specially wired to yield a hot spark every time. This combination obviates all ignition troubles. Is surer and more economical than any other sparking device. Sold by dealers everywhere. Send for name of nearest dealer, and Booklet "Battery Facts," containing valuable ignition information.

Edison Manufacturing Co.
25 Lakeside Avenue
ORANGE, N. J.
31 Union Square, New York
304 Wabash Avenue, Chicago
25 Clerkenwell Road, London, E.C.

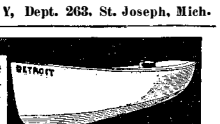


You Can Tell a Truscott—You Can Trust One

Its original cost is no higher than inferior makes; its maintenance much lower. The automatic control saves gasoline, wear and tear, time, trouble and expense. The owner of a Truscott is always sure of running his boat at will, for his own and his friends' pleasure. Send stamps for catalogue. Our quarterly, "The Launch" is Free.

TRUSCOTT BOAT MFG. COMPANY, Dept. 263, St. Joseph, Mich.

Just $94.50 for this complete launch. This is not a small rowboat with an engine, but a full sized modern power boat. We are the largest manufacturers of power boats, canoes and dinghy's in the world. Write to-day for catalog.



Just $94.50

DETROIT BOAT CO. 1302 JEFFERSON AVE. DETROIT, MICH. MEMBERS NAT'L ASSN. BOAT & ENG. MFRS.

AMERICA'S MOST POPULAR RAILWAY
CHICAGO AND ALTON
PERFECT PASSENGER SERVICE

BETWEEN

CHICAGO AND KANSAS CITY,
CHICAGO AND ST. LOUIS,
CHICAGO AND PEORIA,
ST. LOUIS AND KANSAS CITY.

THROUGH PULLMAN SERVICE, BETWEEN CHICAGO AND

HOT SPRINGS, Ark., DENVER, Colo., TEXAS, FLORIDA, UTAH, CALIFORNIA AND OREGON.

IF YOU ARE CONTEMPLATING A TRIP, ANY PORTION OF WHICH CAN BE MADE OVER THE CHICAGO & ALTON, IT WILL PAY YOU TO WRITE TO THE UNDERSIGNED FOR RATES, MAPS, TIME-TABLES, ETC.

GEO. J. CHARLTON,
GENERAL PASSENGER AGENT,
CHICAGO, ILL.

Axes, adzes, and hatchets, Evansville Tool Works	50,589
Baking powder, Jack Frost Baking Powder Co.	50,616
Balls, base, A. J. Reach Co.	50,637
Bats, baseball, A. G. Spalding & Bros.	50,636
Beer, John Brenner Brewing Co.	50,736
Beer, lager, Consumers Park Brewing Co.	50,665
Beverages made of cola nuts, non-alcoholic, J. W. Hall	50,650
Books and paper pads therefor, duplicate sales slip, Carter-Crume Co.	50,583
Boots and shoes, leather, H. L. Bond	50,605
Boots and shoes, leather, E. Goldsberry	50,611
Boots and shoes, leather, Wingo, Ellett & Crump Shoe Co.	50,674
Boots, shoes, and slippers, leather, Preston B. Keith Shoe Co.	50,659
Bottles of square or cubical form, Cook & Bernheimer Co.	50,666
Box toe material and innersoling, F. W. Whitcher	50,600
Buttons, Dieckerhoff, Raffloer & Co.	50,744
Calfskin, patent leather, and waxed calf, Doerr & Reinhart	50,587
Candies of all kinds, Hazelwood Co.	50,681
Candy, Reymer & Brothers	50,690
Canned fruits and vegetables, Pratt-Low Preserving Co.	50,623
Caramels and candies, American Caramel Co.	50,741
Castings and forgings, iron and steel, McConway & Torley Co.	50,628
Chairs and rockers, double caned, Delaware Chair Co.	50,626
Charcoal, B. S. Feiner	50,782
Cheese, neufchatel, W. A. Lawrence & Son.	50,619
Cheviots, haircloth, Eddystone Manufacturing Co.	50,764
Chocolates, Phelps Co.	50,669
Chocolates and bonbons, R. L. Perry Co.	50,689
Cigars, H. T. Offterdinger	50,657
Cigars, S. S. Pierce Co.	50,693
Cigars, cheroots, and cigarettes made of cigar tobacco, Cayey-Caguas Tobacco Co.	50,678
Cigars, cheroots, and stogies, Wisconsin Cigar Co.	50,707
Cleansing and scouring preparation, Palami Co.	50,686
Coats and trousers, J. Samuels & Bro.	50,794
Cocks, stop and waste, A. Y. McDonald & Morrison Manufacturing Co.	50,601
Coffee, A. Schilling & Co.	50,624
Concrete washtrays, Economy Manufacturing Co.	50,607
Condition powders, F. G. Boynton	50,775
Cordial for blending whiskies, A. Reinert	50,660
Cotton cloth, Hewlett & Lee	50,721 to 50,723
Cotton piece goods, Eagle & Phenix Mills	50,716
Cotton piece goods, Massachusetts Cotton Mills	50,750, 50,751
Court plaster, liquid, Carpenter Chemical Co.	50,777
Covert cloths, venetians, broadcloths, and cheviots, A. Berel	50,774
Cretonnes, drapery and upholstery, Eddystone Manufacturing Co.	50,767
Dictionaries, G. & C. Merriam Co.	50,645, 50,646
Driers, liquid, Pratt & Lambert	50,688
Dyes, Paas Dye Co.	50,727, 50,728
Dyestuff, Cassella Color Co.	50,778
Dyspepsia cakes, H. A. C. Dahl	50,714, 50,715
Ejectors, United Injector Co.	50,632
Electric motors, Bartz, Wygant & Brown	50,639
Explosives, Masurite Explosive Co.	50,654
Eyelets and lacing hooks, United Fast Color Eyelet Co.	50,738
Fabrics, cotton textile, Eddystone Manufacturing Co.	50,761
Fabrics, textile, Eddystone Manufacturing Co., 50,732 to 50,734 50,756 to 50,760 50,762, 50,763, 50,765, 50,766,	50,768
Feed, chicken, Ross Brothers	50,691
File, corn, B. Frink	50,644
Flour, wheat, Bay State Milling Co.	50,604
Flour, wheat, Gwinn Bros. & Co.	50,613
Flour, wheat, Pillsbury-Washburn Flour Mills Co.	50,622
Flour, wheat, Sweet Springs Milling Co.	50,630
Flour, wheat, Pillsbury-Washburn Flour Mills Co.	50,687, 50,802
Garments, outer, Levi Strauss & Co.	50,748
Garters, C. J. Higley	50,787
Gelatin, American Glue Co.	50,675
Gloves, kid and lambskin, Stern Brothers	50,755
Glue, Chemische Fabrik fur Lein & Dunger "Zimmermann"	50,679
Glue, C. A. Soden	50,696
Guitars and mandolins, Lyon & Healy	50,591
Hair restorer, L. A. H. Brandt	50,713
Hats and caps, E. M. Knox	50,790
Heel protectors, F. W. Whitcher	50,599
Horseshoes, Bryden Horseshoe Co.	50,582
Hosiery, Cooper, Wells & Co.	50,780
Inks in fluid, crystal, and powdered form, black and colored, A. Turner	50,596
Insecticides, F. L. Hanlin	50,785
Knitted covers for hot water bottles, Gloversville Knitting Co.	50,590
Lamp chimneys, glass, La Bastie Glass Co.	50,618
Lead, white, Toch Brothers	50,704
Leather, chrome tanned, P. Reilly & Son.	50,592
Leather dressings in liquid, paste, and solid form, Frank Miller Co.	50,698
Leather, dull black and colored calf, Barnet Leather Co.	50,603
Liniment, J. M. Hood	50,744
Liniment, W. B. Hadley	50,784
Liniment, P. L. Hoover & Bros.	50,788
Lubricators and parts thereof, force feed, Greene, Tweed & Co.	50,612
Magazines, Tribune Co.	50,633
Malt extracts, Trommer Co.	50,700
Medicinal beverage, A. G. Thompson	50,701
Medicinal preparation, V. de Leo	50,781
Medicine, certain named, C. O. F. Burkstrom	50,776
Medicine for certain named diseases, U. F. Schlaepfer	50,803
Medicine for external use, Antiseptic Pharmacal Co.	50,742
Medicine for internal use, Potter Drug & Chemical Corporation	50,753
Medicine for the cure of liver and kidney diseases, Thompson Medical Co.	50,801
Medicines for purifying the blood, M.I.S.T. Co.	50,798, 50,799
Medicines for the regulation of the liver and purification of the blood, A. H. Lewis Medicine Co.	50,795
Medicines for venereal diseases, C. G. Marino	50,749
Medicines, laxative, S. B. Hartman	50,786
Metals, extruded, Coe Brass Manufacturing Co.	50,625
Milk, preparation made from skim, Ekenberg Milk Products Co.	50,608, 50,609
Nitro compounds, Joveite Manufacturing Co.	50,617
Noodles and macaroni, egg, C. F. Mueller Co.	50,606
Oil, castor, Morris Bros.	50,726
Oil cups, Lunkenheimer Co.	50,595
Oil, olive, A. Zucca	50,708
Oiled clothing, A. J. Tower Co.	50,709
Oilstones, waterstones, whetstones, hones, and grindstones, Scranton Whetstone and Abrasive Wheel Co.	50,699
Ointment, R. B. Ray	50,730
Ointment, Potter Drug & Chemical Corporation	50,754
Overalls, aprons, coats, and pants, Cleveland & Whitehill Co.	50,743
Oysters, Haas Bros.	50,614
Paint and varnish remover, Toch Brothers	50,703
Paper bags, J. Clochessy	50,641
Paper, paper bags, and sacks, wrapping, Hollingsworth & Whitney Co.	50,651
Papers, waterproof, F. W. Bird & Son	50,676
Pharmaceutical preparations for the treatment of kidney diseases, McKesson & Robbins	50,752
Photographic paper and films, Societe Anonyme "Luna"	50,664
Pianos, H. Baumeister	50,581
Pills and cough medicine, S. Holzman	50,724
Pistols, Colt's Patent Fire Arms Manufacturing Co.	50,584, 50,585 50,580
Plows, A. Baldwin & Co.	50,593
Plows, riding and walking, Parlin & Orendorff Co.	50,792
Potash, lye, and caustic soda, A. Mendleson's Sons	

The Car With a "Doctrine"

The "Maxwell"

Doctrine stands behind the construction of every Maxwell car. EXPERIENCE, not theory, is the keynote of the "Doctrine."

One of the Latest Proofs.

The Maxwell was the only car in its class to make a PERFECT SCORE in the Los Angeles-San Diego Endurance Contest of January 25th.

If you are interested in advanced motor construction it will pay you to get the facts about the Maxwell "Doctrine" and the Maxwell Cars.

Multiple Disc Clutch Bevel Gear Drive Three-Point Suspension Metal Bodies No Pump.

Maxwell cars are sold under the positive guarantee that as good a car cannot be sold at a lower price.

16-20 H. P. Touring Car **$1,450**
10 H. P. Tourabout **$780**

Send to Dept. 22 for Catalogue.

MAXWELL-BRISCOE MOTOR CO.
Members American Motor Car Manufacturers' Association
Main Office: Tarrytown, N. Y.
CHICAGO PAWTUCKET

HOME MADE DYNAMOS. — SCIENTIFIC AMERICAN SUPPLEMENTS **161** and **600** contain excellent articles with full drawings. Price 10 cents each, by mail. Munn & Company, 361 Broadway, New York City, and all newsdealers.

BI-PED TACK PULLER

Agents Wanted

One Foot for Matting Tacks One Foot for Carpet Tacks

The *only* tool that lifts tacks *easily, quickly,* without damage to carpets, matting or tacks. Made of best steel, on simple lever principle—everlasting. Feet changed instantly, using only the fingers. Sent postpaid on receipt of 25 cents, also a **Kangaroo Trick Lock, Free, and a Package of Interesting Matter and Samples of Specialties.**

GENERAL SPECIALTY MFG. CO., 1029 ARCADE BLDG., PHILA.

NORTHERN

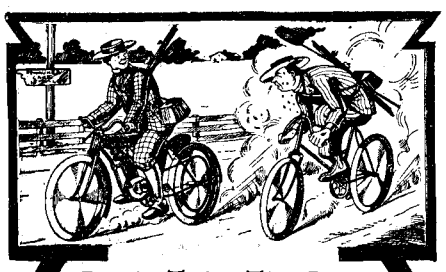
Silent and Dustless.

Our new catalogue explains fully the many exclusive advantages of these cars. Illustrates and prices our full 1906 line including *seven* distinct models—all designed and built for *American roads.*

Silent Northern Touring Car
20 h. p., Double Opposed Motor $1,800 f. o. b. Detroit.

You cannot afford to buy without first investigating the Northern. Write for catalogue 19 to-day.

Northern Manufacturing Co., Detroit, U. S. A.
Member Association of Licensed Automobile Mfrs.



Don't Take The Dust

Don't be "the man behind." If there must be dust, be the raiser of it, not the consumer. To do this, ride a

Merkel Motor Cycle

You will always be in the lead. Interesting book on motoring and motor cycles: also catalog and literature invaluable to the prospective owner of a motor cycle, sent free upon request.

MERKEL MOTOR CO.
1092, Milwaukee
Wis.

I Will Make You Prosperous

If you are honest and ambitious write me today. No matter where you live or what your occupation has been, I will teach you the Real Estate business by mail; appoint you Special Representative of my Company in your town, start you in a profitable business of your own, and help you make big money at once.

Unusual opportunity for men without capital to become independent for life. Valuable book and full particulars free. Write today.

EDWIN R. MARDEN, Pres't
National Co-Operative Realty Co., 1170 Athenaeum Bldg., Chicago

"Here's Your Hat!"

Cartoon by Opper

(Copyrighted, 1906, American Journal Examiner)

The above is a humorous interpretation of a tremendously serious fact With several members summarily asked to resign, five more under indictment, and one dead in state's prison, an abrupt crisis has been reached in the Senate. The situation has been admirably summed up by David Graham Phillips, as follows.

"The Treason of the Senate' Treason is a strong word, but not too strong, rather too weak, to characterize the situation in which the Senate is the eager, resourceful, indefatigable agent of interests as hostile to the American people as any invading army could be—interests that manipulate the prosperity produced by all, so that it heaps up riches for the few—interests whose growth and power can only mean the degradation of the people, of the educated into sycophants, of the masses toward serfdom."

"The Senators, as Senators, are *not* elected by the people—they are elected by the 'interests'; except in extreme and rare and negligible instances, the people can neither elect nor dismiss them."

It is the duty of every intelligent American to get a sane, sound understanding of these appalling facts. To learn the truth, read Mr. Phillips'

"The Treason of the Senate"

—the most scathing, truthful exposure of political corruption in years. Now appearing in the April

10 Cents a Copy **COSMOPOLITAN** One Dollar a Year

At all News-stands or Direct from the COSMOPOLITAN MAGAZINE, 1789 Broadway, N.Y. City

30 Days Free Trial

Your health and that of your children depends largely upon the purity of the water you drink

Useeit

YOU-SEE-IT (THE WATER).

Water Cooler

The most sanitary, economical and perfect device ever invented for dispensing drinking water.

Write for Illustrated Catalogue

Coolers made in six sizes and to fit any bottle, finished in white enamel trimmed in gold and nickel. For office or home. Price $6.00 to $12.00.

We will send one of our water coolers to any reliable person. You may use it 30 days; if perfectly satisfactory, remit for same; if not better than any other water cooler you ever saw, return it at our expense.

Note Advantages;

Water cannot become contaminated even if impure ice is used. Water flows directly from bottle to faucet through coil of pure block tin and is cooled in transit.

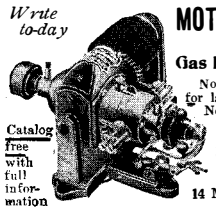
Above cut is a sectional view of our No. 4 cooler finished in white enamel, with two-gallon bottle. Ice capacity ten pounds. **Price $6.00.**

NOTICE.—Our cooler is covered by broad basic patents and we will prosecute vigorously all infringements.

THE CONSUMERS CO., 3517 Butler St., Chicago

Coolers delivered f. o. b. Chicago, New York and San Francisco.

Write to-day



Catalog free with full information

MOTSINGER AUTO-SPARKER

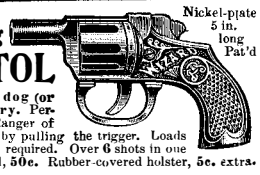
starts and runs Gas Engines without Batteries.

No other machine can do it successfully for lack of original patents owned by us. No twist motion in our drive. No belt or switch necessary. No batteries whatever, for make and break or jump-spark. Water and dust-proof. Fully guaranteed.

MOTSINGER DEVICE MFG. CO.
14 Main Street, Pendleton, Ind., U. S. A.

Wizard Repeating

LIQUID PISTOL



Nickel-plate 5 in. long Pat'd

Will stop the most vicious dog (or man) without permanent injury. Perfectly safe to carry without danger of leakage. Fires and recharges by pulling the trigger. Loads from any liquid. No cartridges required. Over 6 shots in one loading. All dealers, or by mail, **50c.** Rubber-covered holster, **5c. extra.**

Parker, Stearns & Co., 226 South St., Dept. G, New York

Electrical Engineering

and Experimental Work of Every Description

We have every facility for producing first-class work promptly. Our factory is equipped with modern machinery throughout.

C. F. SPLITDORF
Engineering Dept. 17-27 Vandewater St., N. Y. City

SOCIALISM

The most important question of the day. Get posted. Read the greatest Socialist magazine in the world. 300,000 circulation. Send 10c. silver for one year's trial.

GAYLORD WILSHIRE, Editor

"Wilshire's Magazine," 300 Black Bldg., N. Y. City

ANGLE BENDERS

Give up the old expensive vise method and use our quick and powerful hand power benders. Form angles in stock up to 1½ inch. Write to-day for catalogue.

Wallace Supply Co., 921 Garden City Block, Chicago, Ill.

"We Analyze Everything"

At Reasonable Rates

Investigations and Researches. Processes improved. Patent litigation, etc.

MAX D. SLIMMER, Ph.D., 403 Ellsworth Bldg., Chicago

GET A BIRD'S EYE VIEW OF YOUR BUSINESS Route your salesmen, locate customers, indicate prospects and a hundred other items of your business by the **"Map and Tack" System** of keeping track with colored tacks on a map. Write for sample outfit.

John W. Iliff & Co., 852 Wabash Ave., Chicago, Ill.

INVENTORS We manufacture METAL SPECIALTIES of all kinds, to order; largest equipment; lowest prices. Send sample or model for low estimate and best expert advice **FREE**

THE EAGLE TOOL CO., Dept. A, Cincinnati, O.

DO YOU

Want your PATENTS Developed?

Experimentals, Models and fine instrument work. Surveying instrument repairs a specialty.

Richter & Poncet, 115 Court Street, Hoboken, N. J.

Two minutes from D. L. W. Depot

---

60 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &c.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. **HANDBOOK** on Patents sent free. Oldest agency for securing patents.

Patents taken through Munn & Co. receive *special notice*, without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.

MUNN & Co. 361 Broadway, **New York**
Branch Office, 625 F St., Washington, D. C.

Powder, toilet, Stork Co.	50,800
Preparation for external application for rheumatism, liquid, H. E. Fowler	50,745
Preparation for the relief of rheumatism and kindred ailments, G. L. Shafer	50,731
Pretzels, J. S. Bachman	50,602
Remedies for rheumatism for internal and external use, Hot Shot Medicine Co.	50,789
Remedy, antiseptic, H. C. Pope	50,729
Remedy, catarrh, Piso Company	50,771
Remedy, consumption, Piso Company	50,770
Remedy for catarrh, tuberculosis, and allied diseases, Medicinal Balsam Co.	50,797
Remedy for croup and colds, R. P. Menard	50,791
Remedy for hog cholera, J. J. Pater	50,793
Rope, Columbian Rope Co.	50,586
Salve, Bickmore Gall Cure Co.	50,712
Sardines, Von Bremen, MacDonnies & Co.	50,634
Saws, G. N. Clemson	50,640
Shade cloths, Amory, Browne & Co.	50,773
Shaft hangers, C. W. Levalley	50,620
Shirtings, Eddystone Manufacturing Co.	50,769
Shirts as distinguished from undershirts, dress, Elias Bros. & Co.	50,717
Shirts, collars, and cuffs, Cluett Peabody & Co.	50,779
Shoes, ladies', Hahne & Company	50,649
Silver flat ware, hollow ware, and tableware, sterling, Theodore W. Foster & Bro. Co.	50,670
Skirts, M. Goldman & Co.	50,783
Soap, G. A. Schmidt	50,695
Soap chips, J. T. Kenny & Co.	50,682
Soap powder combined with mineral ingredients, Cudahy Packing Co.	50,697
Soap, toilet and laundry, Maple City Soap Works	50,684
Soaps, toilet, Mulhens & Kropff	50,685
Souvenir articles, C. M. Robbins Co.	50,667
Spices, A. Schilling & Co.	50,662
Steel, Crucible Steel Company of America, 50,642,	50,643
Stogies, J. Williams & Bros.	50,672
Stogies, R. & W. Jenkinson Co.	50,737
Suspenders for wearing apparel, R. F. Bartel	50,711
Suspensory bandages and jock straps, S. H. Wetmore Co.	50,629
Syrup and molasses, Francis H. Leggett & Co.	50,610
Talking machine records, Englewood Co.	50,594
Talking machine records, Victor Talking Machine Co.	50,598
Toast, granulated, D. J. Etly	50,588
Tobacco, granulated smoking, F. R. Penn Tob. Co.	50,735
Tobacco, high grade of chewing, Ryan-Hampton Tobacco Co.	50,692
Tobacco, plug chewing, Gilbert Son & Co.	50,680
Tobacco, plug cut, Weisert Brothers Tobacco Co.	50,739
Toilet wash for the skin, R. Glaub	50,720
Tonic beverages and syrups for the same, aerated, Dr. Pepper Co.	50,668
Tooth powder, Woodman-Davis Co.	50,740
Trees, buds, and scions thereof, fruit, Oregon Nursery Co.	50,621
Trunks, suit cases, traveling bags, satchels, and telescopes, Henry Pollack Trunk Co.	50,615
Tubes, iron and steel, Spang, Chalfant & Co.	50,663
Underskirts and drawers and union suits, Deimel Linen-Mesh System Co.	50,796
Varnishes, Toch Brothers	50,702
Varnishes and japans, Valentine & Co.	50,705
Velveteens, A. Wimpfheimer and Brother	50,772
Veterinary remedy, Hamer's Sure Cure Co.	50,746
Wagons, Tiffin Wagon Co.	50,631
Washing machines, Wahle Foundry and Machine Works	50,706
Water, natural, concentrated, and carbonated mineral, Blue Rock Mineral Spring Co.	50,677
Water sprayers, showers, and parts, fixed or portable, J. P. Eustis Mfg. Co.	50,652
Wheelbarrows and the parts thereof, Kilbourne & Jacobs Manufacturing Co.	50,627
Whisky, W. Albrecht	50,638
Whisky, Glasner & Barzen Distilling & Importing Co.	50,647
Whisky, Martin & McAndrews	50,653
Whisky, S. F. Miller	50,655
Whisky, E. E. Nordenholz	50,656
Whisky, T. E. O'Keefe	50,658
Whisky, L. Rosensweig	50,661
Whisky, M. Wortmann	50,673
Whisky, Samuel Westheimer & Son Wholesale Liquor Co.	50,694
Whisky, Figge Doyle Co.	50,718
Whisky, rye, G. Gump & Sons	50,648
Whisky, rye, Ulman, Boykin & Co.	50,671
Wire, United Shoe Machinery Co.	50,597

LABELS.

"Amazon Vegetable Boiler Compound," for a vegetable boiler compound, Amazon Chemical Manufacturing Co.	12,739
"Arcadia Beauty," for canned corn, Wayne County Preserving Co.	12,735
"Burnham," for canned corn, Wayne County Preserving Co.	12,737
"Cleopatra Massage Cream and Skin Food," for a toilet lotion, Facial Toilet Manufacturing Co.	12,740
"Creso," for biscuit, Hitchner Biscuit Co.	12,732
"Decree," for cigars, H. Sommer Co.	12,730
"Faultless," for canned corn, Wayne County Preserving Co.	12,733
"Fel Bovis Button Tablets," for medicine, S. M. & J. I. Lowry	12,742
"Hires The Only Rootbeer," for carbonated rootbeer, Charles E. Hires Co.	12,729
"Holiday Coffee," for coffee, Canby, Ach & Canby Co.	12,731
"John Taylor's Ham," for ham, Taylor Provision Co.	12,738
"Newark," for canned corn, Wayne County Preserving Co.	12,734
"Old Legal Whisky," for whisky, Parker Blake Co.	12,727
"Orcherade," for extracts and beverages, W. H. Hutchinson & Son	12,728
"Prof. Emil Linnebach's Mysterious Remedy for Toothache and Facial Neuralgia," for medicine, E. Linnebach	12,741
"Wayne," for canned corn, Wayne County Preserving Co.	12,736

PRINTS.

"A Trip Around Candies, Johnston," for confections and candies, Hummel & Downing Co.	1,608
"Crescent Acetylene Burners," for acetylene burners, Crescent Burner Manufacturing Co.	1,612
"Royal Ace," for playing cards, Willis W. Russell Card Co.	1,611
"Royal Wrapper," for playing cards, Willis W. Russell Card Co.	1,610
"Sapolin Carriage Gloss Colors," for carriage gloss colors, Gerstendorfer Bros.	1,614
"Star Enamel and Sapolin Floor Stain," for enamel and floor stain, Gerstendorfer Bros.	1,613
"The Eureka, The Standard Water Softener & Purifier of the World," for a water softening and purifying apparatus, H. Romunder	1,607
"The Sign of the Best Glove," for gloves and mittens, Joseph N. Eisendrath Co.	1,609

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

Manufacturers

PERHAPS your factory would find better operating conditions and a market not so sharply competitive in the Santa Fe Southwest.

If you are desirous of investigating this field we will be glad to assist you, and correspondence is invited.

WESLEY MERRITT
Industrial Commissioner
Santa Fe System
Railway Exchange, Chicago

LET US BE YOUR FACTORY
WRITE FOR ESTIMATE ON ANY ARTICLE YOU WANT MANUFACTURED
STAMPINGS, MODELS, EXPER. WORK
WRITE FOR FREE BOOKLET
THE GLOBE MACHINE & STAMPING CO.
970 Hamilton St., Cleveland, O.

MACHINERY AND SPECIAL PARTS BUILT ON CONTRACT
new devices developed; successful experimental work done speedily; skilled labor; good facilities; good value for your money.
J. R. ENGELMAN MFG. CO.
74 Hudson St. near Penn. Depot, Jersey City

ICE MACHINES Corliss Engines, Brewers and Bottlers Machinery. THE VILTER MFG. CO. 899 Clinton St., Milwaukee, Wis.

MODELS & EXPERIMENTAL WORK. Inventions developed. Special Machinery.
E. V. BAILLARD. 24 Frankfort Street, New York.

RUBBER Expert Manufacturers Fine Jobbing Work
PARKER, STEARNS & CO., 228-229 South Street, New York

Experimental Work. Designs for Automatic Machinery.
G. M. MAYER, M.E., 1131 Monadnock Bl., Chicago, Ill.

THE NATIONAL MODEL WORKS.
Best equipped Model Works in the United States.
85-87 Fifth Avenue, CHICAGO

DRYING MACHINES. S. E. WORRELL Hannibal, Mo.

THE SCHWERDTLE STAMP CO.
STEEL STAMPS, LETTERS & FIGURES.
BRIDGEPORT CONN.

Foot and Power Lathes
Send for catalogue and prices
Carroll-Jamieson Machine Tool Co., Batavia, Ohio

WANTED. Mechanical Draftsman, $2.04 per diem. A competitive examination will be held for the above position April 12, 1906. For further information address COMMANDANT, Navy Yard, Portsmouth, N. H.

Experimental & Model Work

Cir. & advice free. Wm. Gardam & Son, 45-51 Rose St., N.Y

NOVELTIES & PATENTED ARTICLES
MANUFACTURED BY CONTRACT. PUNCHING DIES. SPECIAL MACHINERY.
E. KONIGSLOW STAMPING & TOOL WORKS, CLEVELAND, O.

Magical Apparatus.
Grand Book Catalogue. Over 700 engravings
25c. Parlor Tricks Catalogue, free.
MARTINKA & CO., Mfrs., 493 Sixth Ave., New York.

MASON'S NEW PAT. WHIP HOIST
for Outrigger hoists. Faster than Elevators, and hoists direct from teams. Saves handling at less expense.
Manfd. by VOLNEY W. MASON & CO., Inc.
Providence, R. I., U. S. A.

Telegraphy Circular free. Wonderful automatic teacher. 5 styles $2 up. OMNIGRAPH CO., Dept. 52, 39 Cortlandt St., New York.

LEARN WATCHMAKING
We teach it thoroughly in as many months as it formerly took years. Does away with tedious apprenticeship. Money earned while studying. Positions secured. Easy terms. Send for catalog.
ST. LOUIS WATCHMAKING SCHOOL, St. Louis, Mo.

Pays for Itself

Men of limited income are prone to fancy they cannot afford to investigate the merits of the Peck-Williamson *Underfeed* Furnace. Bless your hearts! You are just the ones who should be most interested. Be sure the bankers, lawyers, leading merchants, etc.; are fast learning its merits and are not slow in recognizing them. Besides gaining freedom from ordinary furnace troubles and nuisances, they have found that the

Peck-Williamson Underfeed Furnace

Effects a Saving of 1-2 to 2-3 on Coal Bills

Isn't that an important item to the thrifty bookkeeper, clerk, mechanic or other man of limited income? Foot up the bills for the kind of coal you have been using. Then find out what the same number of tons of the *very cheapest grade coal* obtainable in your neighborhood would have cost you, and the difference is what you would have saved by using a Peck-Williamson *Underfeed* Furnace. It's a simple calculation—a child could make it. Try it for yourself and decide whether it would not pay you to investigate further. You will find it *pays for itself*, besides possessing many points of superiority over the ordinary furnace.

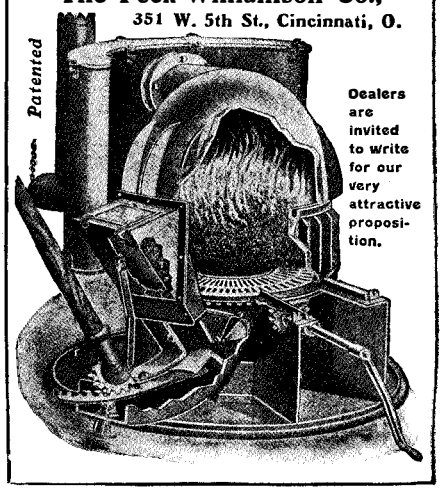
We are not content to make claims in the ordinary way for the Peck-Williamson *Underfeed* Furnace. We let enthusiastic users do that. Here's a sample:

Mr. Howard Shordon, of Ft, Wayne, Ind., wrote us during the coldest weather of last winter as follows:

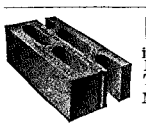
"Your Underfeed Furnace is certainly a wonder. I am heating my eight-roam house at a cost of ten cents per day, and Mr. Volmer is doing the same with his. No dust, smoke or dirt, and no trouble to operate."

We've literally hundreds of such strong letters. Let us mail you **free** fac-simile copies of these letters, together with our interesting, fully descriptive booklet. Heating plans and services of our Engineering Department absolutely free. Don't delay—write to-day—and please give name of local dealer with whom you prefer to deal.

The Peck-Williamson Co.,
351 W. 5th St., Cincinnati, O.



Dealers are invited to write for our very attractive proposition.

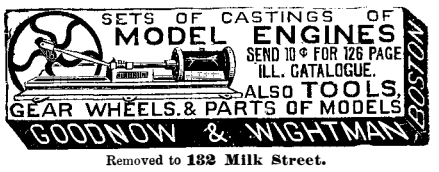


BIG OPPORTUNITIES
in making Concrete Products, Miracle Blocks, Sewer Tile, Brick and Sidewalk Tile. Information free. Catalog A-B.
MIRACLE PRESSED STONE CO.
Minneapolis, Minn.

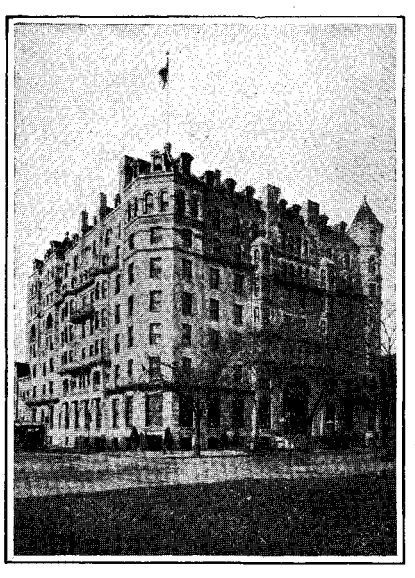
TELESCOPES SEND FOR CATALOGUE
W. & D. MOGEY
BAYONNE CITY, N.J.

STEEL TYPEWRITER TYPE
We make, or will furnish complete outfit for making, all styles. **NEW YORK STENCIL WORKS, 100 Nassau Street, New York.**

ELECTRICAL supplies of all kinds. Motors, Dynamos, Fans, Batteries, Telephones, Telegraph Instruments, Elec. Call Batteries and Toys, Wire Plugs, everything used by professional and amateur electricians. FREE Book giving complete information and ill. of *everything electrical* sent on request.
B. Dewey Elec. Co., Milwaukee, Wis.



Removed to **132 Milk Street.**



THE SHOREHAM,

WASHINGTON, D. C.

The Leading Fashionable Hotel

METROPOLITAN STANDARD OF EXCELLENCE. ABSOLUTELY MODERN AND HIGH CLASS IN ALL DETAIL. AMERICAN AND EUROPEAN PLAN

JOHN T. DEVINE, PROPRIETOR

DON'T BUY GASOLINE ENGINES

UNTIL YOU INVESTIGATE "THE MASTER WORKMAN," a two-cylinder gasoline engine superior to all one-cylinder engines; revolutionizing gas power. Costs Less to Buy and Less to Run. Quickly, easily started. No vibration. Can be mounted on any wagon at small cost—portable, stationary or traction. Mention this paper. SEND FOR CATALOGUE. **THE TEMPLE PUMP CO., Mfrs., Meagher & 15th Sts., Chicago.** THIS IS OUR FIFTY-SECOND YEAR.

New York Belting and Packing Co.

LIMITED

Manufacturers of High Grade

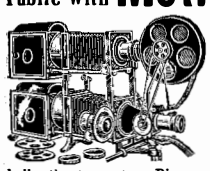
Rubber Belting

Diaphragms, Dredging Sleeves, Emery Wheels; Air Brake, Steam, Suction and Garden Hose, etc., Mats, Matting, Interlocking Rubber Tiling. Also manufacturers of moulded and special rubber goods of every description.

Write for catalogue.

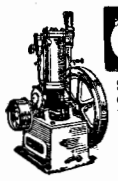
91-93 Chambers St., New York

IT PAYS BIG To amuse the Public With **Motion Pictures**



NO EXPERIENCE NECESSARY as our instruction Book and "Business Guide" tells all. We furnish Complete Outfits with Big Advertising Posters, etc. Humorous dramas brimful of fun, travel, history, religion, temperance work and songs illustrated. One man can do it. **Astonishing Opportunity** in any locality for a man with a little money to show in churches, school houses, lodge halls, theatres, etc. **Big profits each entertainment.** Others do it, why not you? It's easy; write to us and we'll tell you how. **Catalogue free.**

AMUSEMENT SUPPLY CO., 467 Chemical Bank Bldg., CHICAGO



CHARTER

Stationaries, Portables, Hoisters, Pumpers, Sawing and Boat Outfits, Combined with Dynamos.

Gasoline, Gas, Kerosene.

Send for Catalogue.

State Power Needs.

CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.

What Is Daus' Tip-Top?

TO PROVE that Daus' "Tip-Top" is the best and simplest device for making **100 copies** from pen-written and **50 copies** from typewritten original, we will ship complete duplicator, cap size, **without deposit,** on **ten (10) days' trial.** Price $7.50 less trade discount of 33⅓ per cent. or **$5 Net**

The Felix A. B. Daus Duplicator Co., Daus Bldg., 111 John St., New York

---

CRUDE ASBESTOS

DIRECT FROM MINES

PREPARED ASBESTOS FIBRE for Manufacturers use

R. H. MARTIN,

OFFICE, ST. PAUL BUILDING

220 B'way, New York.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes, Sewing Machines, Bicycles, Tools, etc. save Money. Lists Free CHICAGO SCALE CO., Chicago, Ill.

Calendar Watch

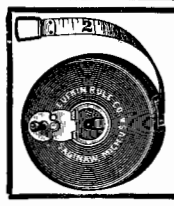
(Cut two-thirds size)

Registers the **Second, Minute, Hour, Day of Week, Date of Month, and Phases of Moon.** Changes **Automatically.** Stem-wind and set; jewelled pivot holes; expansion balance; accurate and reliable; richly decorated dial

Price $7.45

Money refunded if not as represented. Express Prepaid if remittance comes with order. Two or more, **$7 each.** References: Com. Agencies, N. Y. Banks, or any Express Co.

Bellhart Makers & Traders, Ltd., 150 Fifth Ave., New York



LUFKIN

TAPES AND RULES

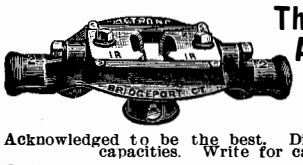
ARE THE BEST.

For sale everywhere. Send for Catalog No. 16.

LUFKIN RULE CO.

Saginaw, Mich., U. S. A.

New York and London.



The Genuine Armstrong's STOCKS and DIES

Acknowledged to be the best. Different sizes and capacities. Write for catalog.

THE ARMSTRONG MFG. CO., Bridgeport, Conn.

New York Office, 139 Centre Street

PARALLEL CHBESLY&Co CLAMPS-ALL ANGLES SIDES=U.S.A. Chicago

15 to 21 South Clinton Street.

RUSH-COUPONS!

Cut out this advertisement, attach to your business stationery and mail to us—or write on your regular letter-head.

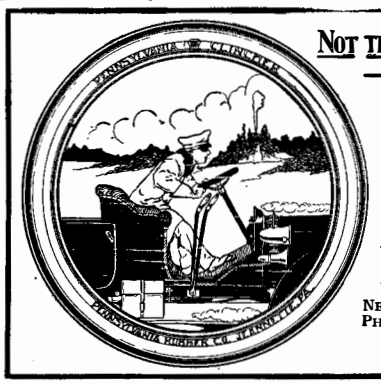
In return we will send free **50 RUSH COUPONS** (printed on COUPON BOND paper).

Pin one of these **RUSH COUPONS** to your next order. It will save you time and worry.

Let us put a pad of these Coupons on your desk with our compliments.

AMERICAN WRITING PAPER COMPANY

35 Mill Street **Holyoke, Massachusetts**



NOT THE STEERING GEAR — BUT THE TIRE —

is the chief essential of control in driving fast heavy cars. On straightaway, curve or emergency, you can absolutely **rely** on the

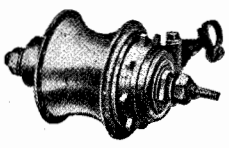
Pennsylvania Clincher—Racing Type

FLAT TREAD

We allow 20 per cent. on old tires

PENNSYLVANIA RUBBER CO. JEANNETTE, PA.

NEW YORK, 1665 Broadway. BOSTON, 167 Oliver St.
PHILADELPHIA, 615 N. Broad St. CHICAGO, 167 Lake St.
LONDON, 4 Snow Hill.



"STANDARD"

Two-Speed Automatic Coaster Brake Hub

Makes wheeling a delight, eliminates the druggery. Do not waste money on experiments when you can buy a perfect attachment *all in* one hub. Our little booklet tells all about it and is mailed free. Write to-day.

THE STANDARD COMPANY - - - - Torrington, Conn.

STEAM USERS

Rainbow Packing

The original and only genuine red sheet packing.

The only effective and most economical flange packing in existence.

Can't blow Rainbow out.

For steam, air, hot or cold water, acid and ammonia joints.

Beware of imitations.

Look for the trade mark—the word Rainbow in a diamond in black, three rows of which extend the full length of each roll.

Manufactured exclusively by

PEERLESS RUBBER MFG. CO.

16 Warren St., New York

A Sixty Year Old Tin Roof

The old First Presbyterian Church at Princeton, N. J., has a roof of old-time hand-made tin. Although laid sixty years ago, it is still in perfect condition and has never been repaired. This is the kind of durability we offer in our "Taylor Old Style" brand—the only roofing tin still made in the old-fashioned, hand-dipped way. Before deciding the roofing question compare the service given by good tin—the original, genuine "Old Style" brand with that of the cheap composition roofs which must be guaranteed for ten or fifteen years to find any takers at all.

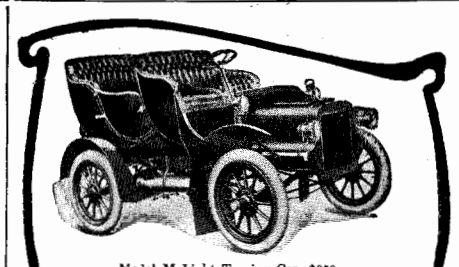
The machine-shop of the Georgia Railroad at Atlanta, Ga., was roofed with tin prior to 1840. This roof is still in good condition after nearly seventy year's wear. This is the kind of roofing material we offer you to-day in our "Taylor Old Style" brand. What other kind can even approach this record?

Let us send you our booklet "A Guide to Good Roofs."

N. & G. TAYLOR COMPANY

ESTABLISHED 1810

Philadelphia



Model M Light Touring Car, $950, f. o. b. Detroit (not including lamps).

Sureness of Service

Of all the reasons why the Cadillac is the car you should own, the greatest is this: *Never-failing serviceableness at a minimum of operating expense.* Whether runabout or touring car, it is an example of careful motor building—a car behind which stand the name and experience of the largest automobile establishment in the world. Every detail of workmanship and material is wrought with that exactness which accompanies superior skill and up-to-date equipment. This is why the

CADILLAC

stands pre-eminent for its dependability and economy of maintenance. Whatever your requirements, there's a Cadillac to meet them perfectly. The single-cylinder types are marvels of power and endurance; their performances are yet to be equaled by any other machines of their class. The four-cylinder cars, built upon the same rugged principles that have made the smaller types famous, combine all that could be desired for touring service.

In design the 1906 Cadillacs are strikingly beautiful; in finish they are truly works of art.

Send for Booklet N, and address of nearest dealer, who by actual demonstration, will convince you of the merits of the Cadillac.

Model K, 10 h. p. Runabout, $750
Model M, Light Touring Car, $950
Model H, 30 h. p. Touring Car, $2,500
Model L, 40 h. p. Touring Car, $3,750
All prices f. o. b. Detroit

CADILLAC MOTOR CAR CO.
Detroit, Mich.

Member Assn. Licensed Auto. Mfrs.

The Apple Automatic Battery Charger

Your Storage Battery

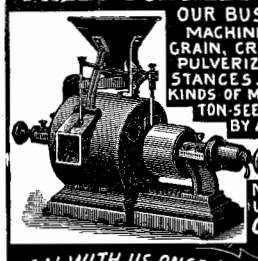
will always be full of "juice" and ready to give fat, hot sparks, if you install an **Apple Battery Charger** on your car, boat or engine.

Thousands of "Auto" owners are using it successfully.

Write for full information to-day.

THE DAYTON ELECTRICAL MFG. CO.
98 St. Clair St., Dayton, O.

MILLS FOR ALL MATERIALS.



OUR BUSINESS IS TO MAKE MACHINERY FOR GRINDING GRAIN, CRUSHING ROCKS AND PULVERIZING ALL HARD SUBSTANCES. WE HANDLE ALL KINDS OF MATERIALS FROM COTTON-SEED TO ROOTS AND HERBS, BY AN UNEXCELLED PROCESS. IF YOU WANT ANY KIND OF A MILL OR GRINDING MACHINE, COME TO US AND YOU WILL GET THE BEST AND STILL SAVE MONEY.

DEAL WITH US ONCE AND YOU WONT CHANGE.

ESTIMATES FREELY FURNISHED.

SPROUT, WALDRON & CO.

(SEND FOR CATALOG No 4.) **MUNCY, PA.**

Bausch & Lomb Microscopes

This is an invitation to send for our illustrated catalog of Microscopes if you are interested in best instruments for the least money, those that are used in the leading laboratories everywhere and by individual workers who know the best.

Bausch & Lomb Optical Co.

MANUFACTURERS

ROCHESTER, N. Y.

NEW YORK CHICAGO BOSTON
SAN FRANCISCO FRANKFORT A-M GERMANY

$43.75

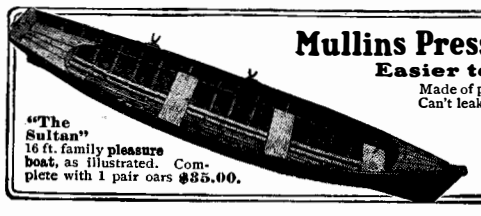
Buys This Rubber Tire Wagon

Union Quality. Fully Guaranteed. Best hickory wheels, ¾ in. **Rubber Tire,** long distance, dust proof, high arched axles; oil-tempered springs. First quality material and finish. Worth nearly double our **Factory Price.** We ship for your examination, without a cent in advance, if desired, and allow

30 DAYS FREE TRIAL

Money refunded on all purchases not satisfactory. **Your save dealers' profits.** We build 150 styles of Vehicles, from $26.50 to $150.00. 50 styles Harness, $5.00 to $60.00. Write to-day for our 200-page **Illustrated Style Book. Free** for the asking.

UNION BUGGY COMPANY, **28 Saginaw Street, Pontiac, Mich.**



"The Sultan" 16 ft. family **pleasure boat,** as illustrated. Complete with 1 pair oars **$35.00.**

Mullins Pressed Steel Boats Can't Sink

Easier to Row—Absolutely Safe

Made of pressed steel, with air chambers in each end like a life boat. Can't leak—crack—dry out or sink—last a lifetime. Every boat guaranteed. The ideal boat for families—summer resorts—parks—boat liveries, etc. Strong—Safe—Speedy. Write today for our large catalog of **row boats, motor boats, hunting and fishing boats.**

The W. H. Mullins Co., 118 Franklin St., Salem, O.

SOLAR LIGHT

the penetrating dazzling brilliancy

The best motor car built is incomplete without

SOLAR LAMPS

There is no danger in the night for the car with the SOLAR because there is light and plenty of it—a brilliant, penetrating light that pierces the distant obstruction and at the same time lightens up the ground right in front of the car.

The SOLAR is extra heavy, extra solid, extra handsome.

BADGER BRASS MFG. CO., Kenosha, Wis.

11 Warren St., New York City